

**REPUBLIC OF KENYA**

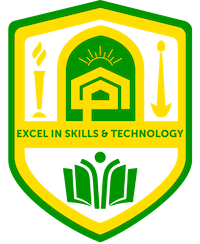
**COMPETENCY-BASED MODULAR CURRICULUM**

**FOR**

**AUTOBODY TECHNOLOGY**

**KNQF LEVEL 6**

**PROGRAMME CODE: 0716 554A**



**THE NYERI NATIONAL POLYTECHNIC**

**P.O BOX 465 - 10100**

**NYERI**

**First published 2025**

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# FOREWORD

The provision of quality education and training is fundamental to the Government’s overall strategy for social and economic development. Quality education and training contribute to the achievement of Kenya’s development blueprint and sustainable development goals.

Reforms in the education sector are necessary to achieve Kenya Vision 2030 and meet the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution, and this resulted in the formulation of the Policy Framework for Reforming Education and Training in Kenya (Sessional Paper No. 14 of 2012). A key feature of this policy is the radical change in the design and delivery of TVET training. This policy document requires that training in TVET be competency-based, curriculum development be industry-led, certification be based on demonstration of competence, and the mode of delivery allow for multiple entry and exit in TVET programmes.

These reforms demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. It is against this background that this curriculum has been developed. For trainees to build their skills on foundational hands-on activities of the occupation, units of learning are grouped in modules. This has eliminated duplication of content and streamlined exemptions based on skills acquired as a trainee progresses in the up-skilling process, while at the same time allowing trainees to be employable in the shortest time possible through the acquisition of part qualifications.

It is my conviction that this curriculum will play a great role in developing competent human resources for the Automotive Engineering Sector’s growth and development.

**PRINCIPAL SECRETARY**

**STATE DEPARTMENT FOR TVET**

**MINISTRY OF EDUCATION**

# PREFACE

Kenya Vision 2030 aims to transform Kenya into a newly industrializing middle-income country, providing high-quality life to all its citizens by the year 2030. Kenya intends to create globally competitive and adaptive human resource base to meet the requirements of a rapidly industrializing economy through lifelong education and training. TVET has a responsibility to facilitate the process of inculcating knowledge, skills, and worker behaviour necessary for catapulting the nation to a globally competitive country, hence the paradigm shift to embrace Competency-Based Education and Training (CBET).

TVET Act, CAP 210A and Sessional Paper No. 1 of 2019 on Reforming Education and Training in Kenya for Sustainable Development emphasized the need to reform curriculum development, assessment, and certification. This called for a shift to CBET to address the mismatch between skills acquired through training and skills needed by industry, as well as increase the global competitiveness of the Kenyan labour force.

This curriculum has been developed in adherence to the Kenya National Qualifications Framework and CBETA standards and guidelines. The curriculum is designed and organized into Units of Learning with Learning Outcomes, suggested delivery methods, learning resources, and methods of assessing the trainee’s achievement. In addition, the units of learning have been grouped in modules to concretize the skills acquisition process and streamline upskilling.

I am grateful to all expert trainers and everyone who played a role in translating the Occupational Standards into this competency-based modular curriculum.

# ACKNOWLEDGMENT

This curriculum has been designed for competency-based training and has independent units of learning that allow the trainee flexibility in entry and exit. In developing the curriculum, significant involvement and support were received from expert trainers, institutions and organizations.

I recognize with appreciation the role of the Engineering and Manufacturing National Sector Skills Committee (NSSC) in ensuring that competencies required by the industry are addressed in the curriculum. I also thank all stakeholders in the Automotive Engineering sector for their valuable input and everyone who participated in developing this curriculum.

I am convinced that this curriculum will go a long way in ensuring that individuals aspiring to work in the Automotive Engineering Sector acquire competencies to perform their work more efficiently and effectively.

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# ACRONYMS

TVETA Technical and Vocational Education Training Authority

NEMA National Environmental Management Authority

OSHA Occupational Health and Safety Act

ICT Information and Communication Technology

KCSE Kenya Certificate of Secondary Education

KNQA Kenya National Qualification Authority

KNQF Kenya National Qualification Framework

TVET Technical and Vocational Education and Training

RAM Random Access Memory

CPU Central processing Unit

HDMI High-Definition multimedia interface

ICT Information and communication technology

USB Universal Serial Bus

PPE Personal Protective Equipment

# KEY TO UNIT CODE



# COURSE OVERVIEW

The Auto Body Level 5 curriculum consists of competencies that a person must achieve to enable him/her to service, maintain motor vehicles in the motor vehicle industry. It includes vehicle glass components installation, vehicle body repaired, glass components maintenance and glazing finishing processes.

The units of competency comprising Auto Body Level 5 qualifications include the following competencies:

# SUMMARY OF UNITS OF LEARNING

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Unit Duration (Hours)** | **Credit** |
| **MODULE I** | | | |
| 0716 251 01A | Vehicle structure welding I | 90 | 9.0 |
| 0716 251 02A | Vehicle body repair | 90 | 9.0 |
| 0716 251 03A | Vehicle Fibre Works | 90 | 9.0 |
| **MODULE II** | | | |
| 0716 351 04A | Vehicle Body Surface Preparation | 90 | 9.0 |
| 0716 351 05A | Vehicle Spray Painting | 120 | 12.0 |
| 0716 351 06A | Vehicle body valeting | 90 | 9.0 |
| **MODULE III** | | | |
| 0031 441 07A | Communication skills | 40 | 4.0 |
| 0417 441 08A | Work ethics and practices | 40 | 5.0 |
| 0541 441 09A | Applied Mathematics | 80 | 8.0 |
| 0732 451 10A | Technical drawing | 80 | 8.0 |
| 0716 451 11A | Vehicle Glass Components Installation | 120 | 12.0 |
| 0716 451 12A | Glazing finishing processes | 120 | 12.0 |
| **MODULE IV** | | | |
| 0611 451 13A | Digital literacy | 40 | 8.0 |
| 0413 441 14A | Entrepreneurial skills | 40 | 6.0 |
| 0715 451 15A | Workshop Technology | 80 | 8.0 |
| 0715 441 16A | Mechanical science | 80 | 8.0 |
| 0713 441 17A | Electronics and Control Principles | 80 | 8.0 |
| 0716 451 18A | Glass components maintenance | 140 | 14.0 |
| **MODULE V** | | | |
| 0732 551 19A | Computer Aided Drawing | 80 | 8.0 |
| 0541 541 20A | Engineering Mathematics | 100 | 10.0 |
| 0715 541 21A | Engineering Mechanics | 80 | 8.0 |
| 0716 551 22A | Vehicle Structure Welding II | 150 | 15.0 |
| **MODULE VI** | | | |
| 0716 551 23A | Vehicle Body design | 140 | 14.0 |
| 0716 551 24A | Vehicle Body trimming | 150 | 15.0 |
| **MODULE VII** | | | |
| 0715 541 25A | Apply Thermodynamics and Fluid Mechanics | 140 | 14.0 |
| 0716 551 26A | Vehicle Structure fabrication | 160 | 16.0 |
| 0716 551 27A | Vehicle Body Parts Assembly | 150 | 15.0 |
|  | Industrial Attachment | **480** | 48 |
| **GRAND TOTAL** | | **3140** | **314.0** |

**Entry Requirements**

An individual entering this course should have any of the following minimum requirements:

1. Kenya certificate of secondary education (KCSE) with a minimum of D plain.

Or

1. KNQF level 5 qualification certificate in Auto body technology or its equivalent.

**Trainer qualification**

A trainer for any of the units of competency in this course must:

1. Possession of at least level 7 qualification in Vehicle Auto Body or its equivalent in Vehicle Auto Body.
2. Registered by TVETA.
3. Be registered by Engineer Board of Kenya (E.B.K) or Kenya Engineering Technology Registration Board (KETRB).

**Industry Training**

An individual enrolled in this course will be required to undergo Industry training for a minimum period of 480 hours in Vehicle Body sector. The industrial training may be taken after completion of all units for those pursuing the full qualification or be distributed equally in each unit for those pursuing part qualification. In the case of dual training model, industrial training shall be as guided by the dual training policy.

**Assessment**

This course will be assessed in both formative and summative as follows;

1. During formative assessment, all performance criteria shall be assessed based on performance criteria weighting.
2. Summative assessment shall focus on critical aspects of the unit of competency.
3. Theory and practical weight shall be as follows:
4. 10:90 for unit in module 1 and module 2 for each unit of learning.
5. 30:70 for units in module 3 and module 4 for each unit of learning.
6. 40:60 for units in module 5 and 6 for each unit of learning.
7. Formative and summative assessment weight shall constitute 60% and 40% of the overall score, respectively.
8. For a candidate to be declared competent in a unit of competency, a candidate shall meet the following conditions:
9. Obtained at least 40% in theory assessment in formative and summative assessments
10. Obtained at least 50% in practical assessment, in formative and summative assessment where applicable.
11. Obtained at least 50% in the weighted results between formative assessment and summative assessment, where the former constitutes 60% and the latter and the latter 40% of the overall score.
12. Assessment performance rating for each of the unit of competence shall be as follows:

|  |  |
| --- | --- |
| **MARKS** | **COMPETENCE RATING.** |
| 80-100 | Mastery |
| 65-79 | Proficiency |
| 50-64 | Competent |
| 49 and below | Not yet competent |
| Y | Assessment malpractice/Irregularities |

1. Assessment for Recognition of Prior Learning (RPL) may lead to award of part and/or full qualification.

**Certification**

A candidate will be issued with a Certificate of Competency upon demonstration of competence in a core Unit of Competency. To be issued with Kenya National TVET Certificate in Autobody Technology KNQF Level 6, the candidate must demonstrate competence in all the Units of Competency as given in the qualification pack. A Statement of Attainment certificate may be issued upon demonstration of competence in a certifiable element within a unit.

The certificates will be issued by the Qualification Awarding Institution

**MODULE I**

**VEHICLE STRUCTURE WELDING I**

**ISCED UNIT CODE:** 0716 251 01A

**Relationship to occupational standards**

This unit addresses the unit of competency: Weld vehicle structure.

**Duration of unit:** 90 Hours

**Unit Description:**

This unit of learning covers the learning outcomes, content, assessment methods, methods of delivery and resources required to train vehicle structure welding. This unit covers competencies required to demonstrate skills to weld vehicle structures. It involves competencies to Gas weld vehicle structure, arc weld vehicle structure and perform housekeeping.

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Gas weld vehicle structure | 35 |
| 2. | Arc Weld Vehicle structure | 35 |
| 3 | Perform House Keeping | 20 |
| **Total** | | **90** |

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Gas weld vehicle structure | * 1. Usage of PPEs      1. Safety Glasses or Goggles      2. Overalls      3. Dust Mask      4. Welding shield      5. Welding Goggles   2. Vehicle body panel assessment      1. Cracks      2. Dents      3. rust   3. Materials, tools and equipment      1. Oxygen and Acetylene Cylinders      2. Welding Torch      3. Safety Glasses or Goggles      4. Overalls      5. Dust Mask      6. Welding shield      7. Welding Goggles   4. Types of joints      1. Spot Weld Joints      2. Seam Weld joints      3. Flanged joints      4. Adhesive bonded joints   5. Gas welding process      1. rightward welding      2. leftward welding   6. Types of flames-      1. carburizing flame      2. oxidizing flame      3. neutral   7. panel polishing      1. grinding      2. sanding | * Practical * Projects * Portfolio of evidence * Written tests |
| 1. Arc Weld Vehicle structure | * 1. Vehicle panels assessment      1. Cracks      2. Dents      3. rust   2. Materials, tools and equipment      1. Welding machine (Arc welder)      2. Electrode holder      3. Ground clamp      4. Welding electrodes      5. Welding cables      6. Welding helmet (with auto-darkening feature welding gloves      7. Welding jacket or apron      8. Safety boots      9. Welding rods      10. Wire brush      11. Chipping hammer      12. Welding table      13. Clamps   3. Types of joints      1. Spot Weld Joints      2. Seam Weld joints      3. Flanged joints      4. Adhesive Bonded Joints   4. methods of arc welding technics      1. rightward welding      2. leftward welding   5. Arc welding equipment      1. Welding machine (Arc welder)      2. Electrode holder      3. Ground clamp      4. Welding electrodes      5. Welding cables      6. Welding helmet (with auto-darkening feature   6. Welding processes   7. Weld polishing      1. Grinding      2. Filing      3. sanding | * Observation * Project * Written assessment * Oral assessment * Portfolio of evidence |
| 1. Perform House Keeping | * 1. Waste disposal and management      1. Recycling      2. Hazardous waste disposal      3. Incineration      4. Landfilling      5. Waste minimization   2. Cleaning of tools and equipment   3. Cleaning of floors | * Observation * Project * Written assessment * Oral assessment |

**Suggested Methods of Instruction**

* Practical
* Project Work
* Demonstrations
* Direct instruction with active learning strategies
* Group Discussions
* Demonstration

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning materials and infrastructure** | | | |
|  | Training Classes: 1 session | 8M\*20M | 1 | 1:25 |
|  | Workshops: 1 practical workshop | 18M\*12M | 1 | 1:25 |
|  | Computer with Internet connectivity |  | 1 | 1:25 |
|  | Projector for presentations |  | 1 | 1:25 |
|  | Whiteboard for collaborative learning |  | 1 | 1:25 |
|  | Textbooks | Vehicle Body Technology Textbooks | 5 pcs | 1:5 |
|  | White board | Quality whiteboard of approximately 4 ft by 8 ft for writing during theory instruction | 1 | 1:25 |
| **B** | **Tools and Equipment** | | | |
|  | Wire Brushes |  | 5 | 1:5 |
|  | Chipping Hammers |  | 5 | 1:5 |
|  | Welding Tables |  | 5 | 1:5 |
|  | Sets of Clamps |  | 10 | 1:3 |
|  | Grinding Tools |  | 10 | 1:3 |
|  | Sanding Tools |  | 2 | 1:13 |
|  | Filing Tools |  | 5 | 1:5 |
|  | Oxygen and Acetylene Cylinder Sets |  | 5 | 1:5 |
|  | Welding Machines (Arc Welders) |  | 5 | 1:5 |
|  | Welding Helmets (with auto-darkening feature) |  | 5 | 1:5 |
|  | Sets of Welding Rods |  | 10 | 1:3 |
|  | Cleaning Kits for Tools and Equipment |  | 10 | 1:3 |
|  | Floor Cleaning Kits (mops, brooms) |  | 5 | 1:5 |
| **C** | **Materials** | | | |
|  | Pairs of clear Safety Glasses or Goggles |  | 25 | 1:1 |
|  | Dust Masks |  | 25 | 1:1 |
|  | Welding Shields |  | 5 | 1:5 |
|  | Welding Goggles |  | 5 | 1:5 |
|  | Pairs of Welding Gloves |  | 2 | 1:13 |
|  | Vehicle Body Assessment Tools (for cracks, dents, rust) |  | 5 | 1:5 |
|  | Recycling Bins |  | 2 | 1:13 |
|  | Hazardous Waste Disposal Containers |  | 3 | 1:8 |

**VEHICLE BODY REPAIR**

**ISCED UNIT CODE:** 0716 251 02A

**Relationship to occupational standards**

This unit addresses the unit of competency: repair vehicle body

**Duration of unit:** 90 Hours

**Unit Description:**

This unit of learning covers the learning outcomes, content, assessment methods, methods of delivery and resources required to train repair vehicle body. This unit covers competencies required to Repair Vehicle Body. It involves competencies in performing vehicle body jacking, performing vehicle body pulling, performing vehicle body panel beating and performing workshop house keeping

**Summary of Learning Outcomes**

By the end of this unit of learning, the trainee will be able to:

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Perform vehicle body jacking | 20 |
| 2. | Perform vehicle body pulling | 30 |
| 3 | Perform vehicle body panel beating | 30 |
| 4. | Perform Workshop House Keeping | 10 |
| **Total** | | **90** |

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| * + - 1. Perform vehicle body jacking | * 1. Work place health and Safety      1. Personal safety      2. Workshop safety      3. Tools Safety   2. Body panel jacking   3. Operation of body jack      1. Hydraulic jack      2. Hoist      3. Pneumatic jack | * Observation * Project * Written assessment * Oral assessment |
| * + - 1. Perform vehicle body pulling | * 1. Workplace health and safety      1. Personal safety      2. Workshop safety      3. Tools safety   2. Vehicle body panels and structures      1. Door      2. Bonnet      3. boot      4. spoiler      5. floor      6. roof      7. under structure   3. vehicle body pulling tools      1. body puller | * Observation * Project * Written assessment * Oral assessment |
| * + - 1. Perform vehicle body panel beating | * 1. Vehicle body panels      1. Door      2. Bonnet      3. boot      4. spoiler      5. floor      6. roof      7. under structure   2. vehicle body panel tools      1. Dinging hammer      2. Chipping hammer      3. Soft hammer      4. Lever      5. Welding machine      6. Dollies      7. Spoons   3. Vehicle body structures      1. Door      2. Bonnet      3. Boot      4. Spoiler      5. Floor      6. Roof      7. Under structure   4. Body filler application      1. Compound filler      2. Hardener      3. Chemical paste   5. Sanding      1. Sand paper      2. File sander      3. Disc sander      4. Sanding block | * Observation * Project * Written assessment * Oral assessment |
| * + - 1. Perform Workshop House Keeping | * 1. Waste disposal and management      1. Recycling      2. Hazardous waste disposal      3. Incineration      4. Landfilling      5. Waste minimization   2. Cleaning and maintenance of tools and equipment      1. Oiling      2. Greasing   3. Storage of tools      1. Toolbox      2. Tool rack | * Observation * Project * Written assessment * Oral assessment |

**Suggested Methods of Instruction**

* Practical
* Project Work
* Demonstrations
* Direct instruction with active learning strategies
* Group Discussions
* Demonstration

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning materials and infrastructure** | | | |
|  | Training Classes: 1 session | 8M\*20M | 1 | 1:25 |
|  | Workshops: 1 practical workshop | 18M\*12M | 1 | 1:25 |
|  | Computer |  | 1 | 1:25 |
|  | Projector for presentations |  | 1 | 1:25 |
|  | Whiteboard for collaborative learning |  | 1 | 1:25 |
|  | Access to Internet |  | 1 | 1:25 |
|  | Textbooks | Textbooks on vehicle body | 5 pcs | **1:5** |
|  | White board | Quality whiteboard of approximately 4 ft by 8 ft for writing during theory instruction | 1 | **1:25** |
| **B** | **Tools and Equipment** | | | |
|  | Body Pullers | Suction cup type, and or spot weld | 5 | 1:5 |
|  | Dinging Hammers |  | 5 | 1:5 |
|  | Chipping Hammers |  | 5 | 1:5 |
|  | Soft Hammers |  | 5 | 1:5 |
|  | Levers |  | 5 | 1:5 |
|  | Dollies |  | 5 | 1:5 |
|  | Spoons |  | 5 | 1:5 |
|  | Tool Oiling Kits |  | 5 | 1:5 |
|  | Greasing Kits |  | 5 | 1:5 |
|  | Toolboxes |  | 3 | 1:8 |
|  | Tool Racks |  | 2 | 1.13 |
|  | Floor Cleaning Kits (mops, brooms) |  | 5 | 1:5 |
|  | Cleaning Kits for Tools and Equipment |  | 1 | 1:25 |
|  | Welding Machines |  | 2 | 1.13 |
| **C** | **Materials** | | | |
|  | Compound Filler |  | 5 | 1:5 |
|  | Hardener |  | 5 | 1:5 |
|  | Chemical Pastes |  | 10 | 1:3 |
|  | Sets of Sandpaper | various grits | 5 | 1:5 |
|  | File Sanders |  | 2 | 1.13 |
|  | Disc Sanders |  | 2 | 1.13 |
|  | Sanding Blocks |  | 10 | 1:3 |
|  | Recycling Bins |  | 2 | 1.13 |
|  | Hazardous Waste Disposal Containers |  | 3 | 1:8 |
|  | Dust Masks |  | 25 | 1:1 |
|  | Hydraulic Jacks |  | 2 | 1:13 |
|  | Hoists |  | 2 | 1:13 |
|  | Pneumatic Jacks |  | 1 | 1:25 |
|  | Safety Glasses or Goggles |  | 25 | 1:1 |

**VEHICLE FIBRE WORKS**

**ISCED UNIT CODE:** 0716 251 03A

**Relationship to occupational standards**

This unit addresses the unit of competency: perform vehicle fibre works

**Duration of unit:** 90 Hours

**Unit Description:**

This unit of learning describes the learning outcomes, content, assessment and delivery methods required in training perform vehicle fibre works. This unit covers competencies required to Perform Vehicle Fibre Works. It involves competencies in reinforcing vehicle fibre structure, repairing vehicle fibre structure and performing housekeeping.

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Reinforce vehicle fibre structure | 30 |
| 2. | Repair vehicle fibre structure | 40 |
| 3 | Perform House Keeping | 20 |
| **Total** | | **90** |

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Reinforce vehicle fibre structure | * 1. Usage of PPEs      1. Safety Glasses or Goggles      2. Overalls      3. Dust Mask      4. Welding shield      5. Welding Goggles   2. Vehicle body panels assessment      1. Door      2. Bonnet      3. Boot      4. Spoiler      5. Roof      6. Bumper   3. Tools and equipment      1. Dinging hammer      2. Chipping hammer      3. Soft hammer      4. Lever      5. Welding machine      6. Dollies      7. Spoon   4. Fibre materials      1. Fibre glass   5. Materials tools and equipment      1. Resin      2. Hardener      3. Fiberglass mat      4. Carbon fiber fabric      5. Epoxy resin      6. Polyester resin | * Observation * Project * Written assessment * Oral assessment |
| 1. Repair vehicle fibre structure | * 1. Workplace health and safety      1. Personal safety      2. Workshop safety      3. Tools safety      4. material safety   2. Identification of vehicle fibre panels      1. Bumper      2. Hood      3. Dashboard      4. Trunk lid      5. Body panels   3. Fibre materials      1. Fibre glass      2. Resin      3. Hardener      4. Fiberglass mat      5. Carbon fiber fabric      6. Epoxy resin      7. Polyester resin   4. Fibre structure shaping      1. Moldings      2. Weaving   5. Vehicle body filler      1. Compound filler      2. Hardener      3. Chemical paste | * Observation * Project * Written assessment * Oral assessment |
| 1. Perform House Keeping | * 1. Waste disposal and management      1. Recycling      2. Hazardous waste disposal      3. Incineration      4. Landfilling      5. Waste minimization   2. Cleaning and storing of tools and equipment | * Observation * Project * Written assessment * Oral assessment |

**Suggested Methods of Instruction**

* Practical
* Project Work
* Demonstrations
* Direct instruction with active learning strategies
* Group Discussions
* Demonstration

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning materials and infrastructure** | | | |
|  | Training Classes: 1 session | 8M\*20M | 1 | 1:25 |
|  | Workshops: 1 practical workshop | 18M\*12M | 1 | 1:25 |
|  | Computer |  | 1 | 1:25 |
|  | Projector for presentations |  | 1 | 1:25 |
|  | Whiteboard for collaborative learning |  | 1 | 1:25 |
|  | Access to Internet |  | 1 | 1:25 |
|  | Textbooks | Vehicle body Technology Textbooks | 5 pcs | 1:5 |
|  | White board | Quality whiteboard of approximately 4 ft by 8 ft for writing during theory instruction | 1 | 1:25 |
| **B** | Tools and Equipment | | | |
| 1 | Pairs of Safety Glasses or Goggles |  | 25 | 1:1 |
| 2 | Safety Goggles |  | 5 | 1:5 |
| 3 | Dinging Hammers |  | 5 | 1:5 |
|  | Chipping Hammers |  | 5 | 1:5 |
|  | Soft Hammers |  | 5 | 1:5 |
|  | Levers |  | 5 | 1:5 |
|  | Dollies |  | 5 | 1:5 |
|  | Spoons |  | 5 | 1:5 |
|  | Cleaning Kits for Tools and Equipment |  | 5 | 1:5 |
|  | Tool Storage Boxes |  | 2 | 1:13 |
|  | Tool Racks |  | 2 | 1:13 |
|  | Sets of Molding Tools |  | 2 | 1:13 |
|  | Weaving Tools |  | 5 | 1:5 |
| **C** | **Materials** | | | |
| 1 | Kits of Fiberglass (sheets or rolls) |  | 5 | 1:5 |
|  | Liter of Resin |  | 5 | 1:5 |
|  | Pieces of Hardener |  | 2 | 1:13 |
|  | Rolls of Fiberglass Mat |  | 1 | 1:25 |
|  | Rolls of Carbon Fiber Fabric |  | 1 | 1:25 |
|  | 1 liter of Epoxy Resin |  | 2 | 1:13 |
|  | 1 liter of Polyester Resin |  | 1 | 1:25 |
|  | Waste Bins for Recycling |  | 2 | 1:13 |
|  | Hazardous Waste Disposal Containers |  | 3 | 1:8 |
|  | Dust Masks |  | 25 | 1:1 |

**MODULE II**

**VEHICLE BODY SURFACE PREPARATION**

**ISCED UNIT CODE:** 0716 351 04A

**Relationship to occupational standards**

This unit addresses the unit of competency: perform vehicle body surface preparation

**Duration of unit:** 90 Hours

**Unit Description:**

This unit specifies the competencies required to prepare vehicle body surface. It involves; applying primer, applying spot putty, perform wet sanding and perform housekeeping.

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Primer Application | 20 |
| 2. | Spot Putty Application | 30 |
| 3 | Wet Sanding | 30 |
| 4 | House Keeping | 10 |
| **Total** | | **90** |

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| * 1. Primer Application | * 1. Workplace health and safety      1. Personal safety      2. Workshop safety      3. Tools safety      4. Material safety   2. Selection of Tools, materials and equipment      1. Body surface primer      2. Assorted sand papers      3. Sander      4. Masking tape      5. Masking papers      6. Spray gun      7. Acrylic thinner      8. Air compressor      9. Hose pipes      10. Measuring cup      11. Spraying booth      12. Detergents      13. Bucket of water   3. Application of primer   4. Sanding      1. Assorted sand papers      2. Sanding discs | * Practical * Observation * Project * Written assessment * Oral assessment |
| 1. Spot Putty Application | 2.1 Inspection of Vehicle body panels   * + 1. Bonnet     2. Wing     3. Hood     4. Roof     5. Doors     6. Boot     7. Spoiler   1. Application of spot putty   2. Sanding      1. Assorted sand papers      2. sander      3. Assorted sanding discs | * Practical * Observation * Project * Written assessment * Oral assessment |
| 3. Wet Sanding | * 1. Tools materials and equipment      1. Sand paper/assorted sand papers      2. Sander      3. Detergent      4. Bucket of water   2. Drying | * Observation * Project * Practical * Written assessment * Oral assessment |
| 1. House Keeping | * 1. Waste disposal and management      1. segregation of waste   2. cleaning and storing of tools and equipment      1. dusting      2. cleaning | * practical * Observation * Project * Written assessment * Oral assessment |

**Suggested Methods of Instruction**

* Practical
* Project Work
* Demonstrations
* Direct instruction with active learning strategies
* Group Discussions
* Demonstration

**Recommended Resources for 25 Trainees**

| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio (Item: Trainee)** |
| --- | --- | --- | --- | --- |
| **A Learning Materials** | | | | |
| 1 | Textbooks | Comprehensive textbooks on workplace safety, tools, materials, and automotive body repair techniques | 25 | 1:1 |
| 2 | Projector | Functional projector for displaying content during presentations | 1 | 1:25 |
| 3 | Computer | Functional desktop computer with online instructional content | 1 | 1:25 |
| 4 | Whiteboard | Quality whiteboard, approximately 6 ft by 3 ft | 1 | 1:25 |
| 5 | Printer | Inkjet or laser printer for printing handouts, instructions, and diagrams | 1 | 1:25 |
| **B Learning Facilities** | | | | |
| 1 | Lecture Room | Spacious room with seating for 25 trainees, approximately 60 sqm | 1 | 1:25 |
| 2 | Workshop | Standard workshop with designated sanding, painting, and finishing areas (approx. 180 sqm) | 1 | 1:25 |
|  | Spray Painting Booth | Standard spray-painting booth | 1 | 1:25 |
| **C Safety Equipment** | | | | |
| 1 | Dust coat/overall | Shields skin and clothes from dust and paint | 25 | 1:1 |
| 2 | Gloves | Protects hands during sanding, painting, and tool handling | 25 | 1:1 |
| 3 | Safety glasses | Protects eyes from flying particles and chemicals | 25 | 1:1 |
| 4 | Respirators | Protects from inhaling harmful fumes and dust | 25 | 1:1 |
| 5 | Ear plugs/muffs | Protects against prolonged exposure to high noise levels | 25 | 1:1 |
| 6 | First Aid Kit | Fully equipped First Aid kit for accidents | 1 | 1:25 |
| **D Tools and Materials** | | | | |
| 1 | Spreaders | Used for applying and spreading filler | 10 | 2:5 |
| 2 | Mixers | For mixing fillers and hardeners | 5 | 1:5 |
| 3 | Sandpapers | Various grits (36, 40, 60, 80, 100, 120, 240, etc.) | Enough | - |
| 4 | Manual Sanders | Hand tools for sanding surfaces | 10 | 2:5 |
| 5 | Power Sanders | Electric sanders for quicker and consistent sanding | 5 | 1:5 |
| 6 | Sealants | Different types (polyurethane, silicone, acrylic, etc.) for bonding and sealing | 10 sets | 1:3 |
| 7 | Paint mixing scales | For accurate measurement of paint ratios | 5 | 1:5 |
| 8 | Spray Guns | HVLP and LVLP types for primer and paint application | 5 | 1:5 |
| 9 | Compressor Machine | To power spray painting equipment | 1 | 1:25 |
| 10 | Masking Tools | Tape, masking paper, plastic wrap | Enough | - |
| **E Consumables** | | | | |
| 1 | Automotive primer |  | 10 liters | - |
| 2 | Degreasers and solvents | For cleaning surfaces | 10 liters | - |
| 3 | Paint thinner | For cleaning spray guns and thinning paint | 5 liters | - |
| 4 | Rust inhibitors | For preventing corrosion | 5 liters | - |
| 5 | Adhesive removers | For removing adhesives | 5 liters | - |
| **F Reference Materials** | | | | |
| 1 | Training manuals | Comprehensive course materials and guides | 25 pcs | 1:1 |
| 2 | Manufacturer manuals | Detailed manuals for automotive paints and equipment | 1 | 1:25 |
| 3 | Digital presentations | Pre-prepared slides on techniques and safety protocols | 1 | 1:25 |

**VEHICLE SPRAY PAINTING**

**ISCED UNIT CODE:** 0716 351 05A

**Relationship to occupational standards**

This unit addresses the unit of competency; perform vehicle spray painting

**Duration of unit:** 120 Hours

**Unit Description:**

This unit specifies the competencies required to perform vehicle spray painting. It involves; performing vehicle paint mixing, applying vehicle body paint and performing workshop housekeeping.

The unit specifies the knowledge and attitude to perform vehicle spray painting. It involves; troubleshooting, knowledge on colour mixing, use of vehicle body workshop tools and equipment, performing workplace housekeeping procedure, time management, decision making and vehicle body principles.

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Vehicle Paint Mixing | 40 |
| 2. | Vehicle Body Paint | 50 |
| 3 | Workshop House Keeping | 30 |
| **Total** | | **120** |

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Vehicle Paint Mixing | * 1. Workplace health and safety      1. Personal safety      2. Workshop safety      3. Tools safety      4. material safety   2. Selection of tools, materials and equipment      1. Masking tape      2. Dust masks      3. Masking papers      4. Spray gun      5. Acrylic thinner      6. Air compressor      7. Hose pipes      8. Measuring cup      9. Spraying booth      10. Automotive paints      11. Colour code chart   3. Auto paints      1. Water based      2. Acrylic      3. Oil based   4. Colour mixing      1. Colour code chart | * Observation * Project * Written assessment * Oral assessment |
| * 1. Vehicle Body Paint | 1. Cleaning and masking    * 1. Masking tape      2. Dust masks      3. Masking papers      4. Soft material    1. Selection of tools equipment and materials       1. Spray gun       2. Air compressor       3. Hose pipe       4. Automotive paints       5. Thinner       6. Paint hardener    2. Paint mixing       1. Colours       2. Paint mixing machine       3. Colour chart    3. Spray painting elements       1. Ventilation       2. Spray booth       3. Protective gear       4. Lighting       5. Temperature and humidity control    4. Spray painting patterns       1. Horizontal stripe       2. Vertical stripe       3. Circular pattern       4. Diagonal pattern       5. Fan pattern | * Observation * Project * Written assessment * Oral assessment |
| * 1. . Workshop House Keeping | * 1. Waste disposal and management      1. segregation of waste   2. Cleaning and storing of tools and equipment      1. dusting      2. cleaning | * Observation * Project * Written assessment * Ora assessment |

**Suggested Methods of Instruction**

* Practical
* Project Work
* Demonstrations
* Direct instruction with active learning strategies
* Group Discussions
* Demonstration

**Recommended Resources for 25 Trainees**

| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio (Item: Trainee)** |
| --- | --- | --- | --- | --- |
| **ALearning Materials** | | | | |
| 1 | Textbooks | Comprehensive textbooks on workplace safety, tools, materials, and automotive body repair techniques | 25 | 1:1 |
| 2 | Projector | Functional projector for displaying content during presentations | 1 | 1:25 |
| 3 | Computer | Functional desktop computer with online instructional content | 1 | 1:25 |
| 4 | Whiteboard | Quality whiteboard, approximately 6 ft by 3 ft | 1 | 1:25 |
| 5 | Printer | Inkjet or laser printer for printing handouts, instructions, and diagrams | 1 | 1:25 |
| **BLearning Facilities** | | | | |
| 1 | Lecture Room | Spacious room with seating for 25 trainees, approximately 60 sqm | 1 | 1:25 |
| 2 | Workshop | Standard workshop with designated sanding, painting, and finishing areas (approx. 180 sqm) | 1 | 1:25 |
|  | Spray Painting Booth | Standard spray-painting booth | 1 | 1:25 |
| **CSafety Equipment** | | | | |
| 1 | Dust coat/overall | Shields skin and clothes from dust and paint | 25 | 1:1 |
| 2 | Gloves | Protects hands during sanding, painting, and tool handling | 25 | 1:1 |
| 3 | Safety glasses | Protects eyes from flying particles and chemicals | 25 | 1:1 |
| 4 | Respirators | Protects from inhaling harmful fumes and dust | 25 | 1:1 |
| 5 | Ear plugs/muffs | Protects against prolonged exposure to high noise levels | 25 | 1:1 |
| 6 | First Aid Kit | Fully equipped First Aid kit for accidents | 1 | 1:25 |
| **DTools and Materials** | | | | |
| 1 | Spreaders | Used for applying and spreading filler | 10 | 2:5 |
| 2 | Mixers | For mixing fillers and hardeners | 5 | 1:5 |
| 3 | Sandpapers | Various grits (36, 40, 60, 80, 100, 120, 240, etc.) | Enough | - |
| 4 | Manual Sanders | Hand tools for sanding surfaces | 10 | 2:5 |
| 5 | Power Sanders | Electric sanders for quicker and consistent sanding | 5 | 1:5 |
| 6 | Sealants | Different types (polyurethane, silicone, acrylic, etc.) for bonding and sealing | 10 sets | 1:3 |
| 7 | Paint mixing scales | For accurate measurement of paint ratios | 5 | 1:5 |
| 8 | Spray Guns | HVLP and LVLP types for primer and paint application | 5 | 1:5 |
| 9 | Compressor Machine | To power spray painting equipment | 1 | 1:25 |
| 10 | Masking Tools | Tape, masking paper, plastic wrap | Enough | - |
| **EConsumables** | | | | |
| 1 | Automotive paints | Different finishes (solid, metallic, pearl, matte) |  | - |
| 2 | Degreasers and solvents | For cleaning surfaces | 10 liters | - |
| 3 | Paint thinner | For cleaning spray guns and thinning paint | 5 liters | - |
| 4 | Rust inhibitors | For preventing corrosion | 5 liters | - |
| 5 | Adhesive removers | For removing adhesives | 5 liters | - |
| **FReference Materials** | | | | |
| 1 | Training manuals | Comprehensive course materials and guides | 25 pcs | 1:1 |
| 2 | Manufacturer manuals | Detailed manuals for automotive paints and equipment | 1 | 1:25 |
| 3 | Digital presentations | Pre-prepared slides on techniques and safety protocols | 1 | 1:25 |

**VEHICLE BODY VALETING**

**ISCED UNIT CODE:** 0716 351 06A

**Relationship to occupational standards**

This unit addresses the unit of competency; perform vehicle body valeting

**Duration of unit:** 90 Hours

**Unit Description:**

This unit of learning specifies the competencies required to perform vehicle body Valeting. It involves; perform vehicle body polishing, perform vehicle body buffing, and perform housekeeping.

**Summary of Learning Outcomes**

By the end of this unit of learning the trainee should be able to;

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Vehicle Body Polishing | 35 |
| 2. | Vehicle Body Buffing | 45 |
| 3 | House Keeping | 10 |
| **Total** | | **90** |

**Learning Outcomes, Content and Suggested assessment methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Vehicle Body Polishing | * 1. Workplace health and safety      1. Personal safety      2. Workshop safety      3. Tools safety      4. Material safety   2. Selection of tools, materials and equipment      1. Polishing compound      2. Microfiber clothing      3. Polishing pads      4. Buffing pads      5. Polishing wax      6. Fine grit sandpaper   3. Polishing and waxing | * Observation * Project * Written assessment * Oral assessment * Portfolio of evidence |
| 1. Vehicle Body Buffing | * 1. Workplace health and safety      1. Personal safety      2. Workshop safety      3. Tools safety      4. material safety   2. selection of tools, materials and equipment      1. Buffing compounds      2. Buffing pads      3. Buffing machine      4. Buffing wax | * Observation * Project * Written assessment * Oral assessment * Portfolio of evidence |
| 1. House Keeping | * 1. Waste disposal and management      1. segregation of waste   2. Cleaning and storage of tools and equipment      1. dusting      2. cleaning |  |

**Suggested Methods of Instruction**

* Practical
* Project Work
* Demonstrations
* Direct instruction with active learning strategies
* Group Discussions
* Demonstration

**Recommended Resources for 25 Trainees**

| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio (Item: Trainee)** |
| --- | --- | --- | --- | --- |
| 1. **Learning Materials** | | | | |
| 1 | Textbooks | Comprehensive textbooks on workplace safety, tools, materials, and automotive body repair techniques | 25 | 1:1 |
| 2 | Projector | Functional projector for displaying content during presentations | 1 | 1:25 |
| 3 | Computer | Functional desktop computer with online instructional content | 1 | 1:25 |
| 4 | Whiteboard | Quality whiteboard, approximately 6 ft by 3 ft | 1 | 1:25 |
| 5 | Printer | Inkjet or laser printer for printing handouts, instructions, and diagrams | 1 | 1:25 |
| **B Learning Facilities** | | | | |
| 1 | Lecture Room | Spacious room with seating for 25 trainees, approximately 60 sqm | 1 | 1:25 |
| 2 | Workshop | Standard workshop with designated sanding, painting, and finishing areas (approx. 180 sqm) | 1 | 1:25 |
|  | Spray Painting Booth | Standard spray-painting booth | 1 | 1:25 |
| **C Safety Equipment** | | | | |
| 1 | Dust coat/overall | Shields skin and clothes from dust and paint | 25 | 1:1 |
| 2 | Gloves | Protects hands during sanding, painting, and tool handling | 25 | 1:1 |
| 3 | Safety glasses | Protects eyes from flying particles and chemicals | 25 | 1:1 |
| 4 | Respirators | Protects from inhaling harmful fumes and dust | 25 | 1:1 |
| 5 | Ear plugs/muffs | Protects against prolonged exposure to high noise levels | 25 | 1:1 |
| 6 | First Aid Kit | Fully equipped First Aid kit for accidents | 1 | 1:25 |
| **D Tools and Materials** | | | | |
| 1 | Spreaders | Used for applying and spreading filler | 10 | 2:5 |
| 2 | Mixers | For mixing fillers and hardeners | 5 | 1:5 |
| 3 | Sandpapers | Fine grits | 50 pieces | - |
| 4 | Manual Sanders | Hand tools for sanding surfaces | 10 | 2:5 |
| 5 | Power Sanders | Electric sanders for quicker and consistent sanding | 5 | 1:5 |
| 6 | Buffing Machines | Powered | 5 | 1:5 |
| 7 | Waste bins | For housekeeping | 5 | 1:5 |
| 8 | Cleaning solvents and materials | For housekeeping | 5 sets | 1:5 |
| **E Consumables** | | | | |
| 1 | Degreasers and solvents | For cleaning surfaces | 10 liters | 1:2.5 |
| 2 | Polishing Compound | For polishing | 10 liters | 1:2.5 |
| 3 | Microfiber Cloths | For cleaning and polishing | 25 pieces | 1:1 |
| 4 | Polishing Pads | 10 sets | 10 sets | 1:2.5 |
| 5 | Polishing Wax | 10 sets | 10 liters | 1:2.5 |
| 6 | Fine Grit Sandpaper | For fine sanding | 10 packets | 1:2.5 |
| 7 | Buffing Pads | For buffing | 10 sets | 1:2.5 |
| 8 | Buffing Wax | For buffing | 10 liters | 1:2.5 |
| 9 | Buffing Compounds | For buffing | 10 liters | 1:2.5 |
| **F Reference Materials** | | | | |
| 1 | Training manuals | Comprehensive course materials and guides | 25 pcs | 1:1 |
| 2 | Manufacturer manuals | Detailed manuals for automotive paints and equipment | 1 | 1:25 |
| 3 | Digital presentations | Pre-prepared slides on techniques and safety protocols | 1 | 1:25 |

**MODULE III**

**COMMUNICATION SKILLS**

**ISCED UNIT CODE:** **0031 441 07A**

**Relationship with Occupational Standards**

This unit addresses the Unit of Competency: Apply Communication Skills

**Duration of Unit:** **40 Hours**

**Unit Description**

This unit covers the competencies required to apply communication skills. It involves applying communication channels, written, non-verbal, oral, and group communication skills.

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **S/No.** | **Learning Outcomes** | **Duration (Hours)** |
|  | Apply communication channels. | 10 |
|  | Apply written communication skills. | 12 |
|  | Apply non-verbal skills. | 4 |
|  | Apply oral communication skills. | 4 |
|  | Apply group communication skills. | 10 |
|  | | 40 |

**Learning Outcomes, Content, and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Apply communication channels | * 1. Communication process   2. Principles of effective communication   3. Channels/medium/modes of communication   4. Factors to consider when selecting a channel of communication   5. Barriers to effective communication   6. Flow/patterns of communication   7. Sources of information   8. Organizational policies | * Oral questions * Written assessment * Observation * Portfolio of Evidence * Practical assessment * Third party report |
| 1. Apply written communication skills | * 1. Types of written communication   2. Elements of communication   3. Organization requirements for written communication | * Oral assessment * Written assessment * Observation * Portfolio of Evidence * Practical assessment * Third party report |
| 1. Apply non-verbal communication skills | * 1. Utilize body language and gestures   2. Apply body posture   3. Apply workplace dressing code | * Oral assessment * Written assessment * Observation * Portfolio of Evidence * Practical assessment * Third party report |
| 1. Apply oral communication skills | * 1. Types of oral communication pathways   2. Effective questioning techniques   3. Workplace etiquette   4. Active listening | * Oral assessment * Written assessment * Observation * Portfolio of Evidence * Practical assessment * Third party report |
| 1. Apply group discussion skills | * 1. Establishing rapport      1. Facilitating resolution of issues      2. Developing action plans      3. Group organization techniques      4. Turn-taking techniques      5. Conflict resolution techniques      6. Team-work | * Oral assessment * Written assessment * Observation * Portfolio of Evidence * Practical assessment |

**Suggested Methods of Instruction**

* Discussion
* Roleplaying
* Simulation
* Direct instruction
* Demonstration
* Field trips

**Recommended Resources for 30 trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio (Item: Trainee)** |
| **A** | **Learning Materials** |  |  |  |
|  | Textbooks | Comprehensive texts books on Communication Skills | 30 pcs | 1:1 |
|  | Mobile Phones | Smartphone for use by trainees | 30 pcs | 1:1 |
|  | Internet connection | Internet connection to aid communication between trainees |  |  |
|  | PowerPoint Presentations | For trainer’s use, covering course content and practical applications | 1 | 1:30 |
|  | Projector | Functional projector for displaying content during presentations | 1 | 1:30 |
|  | White board | Quality whiteboard of approximately 6 ft by 3 ft for writing during theory instruction | 1 | 1:30 |
|  | Printer | An ink-jet, laser-jet or toner-cartridge printer for printing notes, instructions and working drawings | 1 | 1:30 |
|  | Templates | Templates for creating various documents e.g. CV, Cover Letter, minutes, reports etc. | 30 | 1:1 |
| **B** | **Learning Facilities & Infrastructure** |  |  |  |
|  | Lecture/Theory Room  /Learning Resource  Area\* | Spacious, equipped with projectors and Seats for 30 trainees, approximately 45 sqm (5 m x 9 m) | 1 | 1:30 |
|  | Computer Laboratory | Equipped with at least 30 functional computers with internet connectivity and the following software:   * + - Windows/ Linux/ Macintosh Operating System     - Microsoft Office Software     - Google Workspace Account     - Antivirus Software | 30 | 1:1 |
| **C** | **Consumable Materials** |  |  |  |
|  | Printing Papers | A4 and A3 Printing papers suitable for the task | Enough |  |
|  | Flashcards | For carrying out various activities by trainees | Enough |  |
|  | Flipcharts | Sufficient for group work activities and displaying | Enough |  |
|  | Whiteboard Marker Pens | Dry-erase markers for trainers use. Assorted colors | Enough |  |

**WORK ETHICS AND PRACTICES**

**ISCED UNIT CODE:** **0417 441 08A**

**Relationship with Occupational Standards**

This unit addresses the Unit of Competency: Apply work ethics and practices.

**Duration of Unit: 40 Hours**

**Unit Description**

This unit covers competencies required to demonstrate employability skills. It involves the ability to: conduct self-management, promote ethical work practices and values, promote teamwork, manage workplace conflicts, maintain professional and personal development, apply problem-solving, and promote customer care.

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **S/No.** | **Learning Outcomes** | **Duration (Hours)** |
|  | Apply self-management skills | 10 |
|  | Promote ethical practices and values | 4 |
|  | Promote Teamwork | 10 |
|  | Maintain professional and personal development | 10 |
|  | Apply Problem-solving skills | 4 |
|  | Promote Customer care. | 2 |
|  | | 40 |

**Learning Outcomes, Content, and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Apply self-management skills | * 1. Self-awareness   2. Formulating personal vision, mission, and goals   3. Healthy lifestyle practices   4. Strategies for overcoming work challenges   5. Emotional intelligence   6. Coping with Work Stress.   7. Assertiveness versus aggressiveness and passiveness      1. Developing and maintaining high self-esteem      2. Developing and maintaining positive self-image      3. Time management      4. Setting performance targets      5. Monitoring and evaluating performance targets | * Observation * Written assessment * Oral assessment * Third party reports * Portfolio of evidence * Project * Practical |
| 1. Promote ethical work practices and values | * 1. Integrity   2. Core Values, ethics and beliefs   3. Patriotism   4. Professionalism   5. Organizational codes of conduct   6. Industry policies and procedures | * Observation * Written assessment * Oral assessment * Third party reports * Portfolio of evidence * Project * Practical |
| 1. Promote Teamwork | * 1. Types of teams   2. Team building      1. Individual responsibilities in a team      2. Determination of team roles and objectives      3. Team parameters and relationships      4. Benefits of teamwork      5. Qualities of a team player      6. Leading a team      7. Team performance and evaluation   3. Conflicts and conflict resolution   4. Gender and diversity mainstreaming   5. Developing Healthy workplace relationships   6. Adaptability and flexibility   7. Coaching and mentoring skills | * Observation * Written assessment * Oral assessment * Third party reports * Portfolio of evidence * Project * Practical |
| 1. Maintain professional and personal development | * 1. Personal vs professional development and growth   2. Avenues for professional growth   3. Recognizing career advancement   4. Training and career opportunities      1. Assessing training needs      2. Mobilizing training resources   5. Licenses and certifications for professional growth and development   6. Pursuing personal and organizational goals   7. Managing work priorities and commitments   8. Dynamism and on-the-job learning | * Observation * Written assessment * Oral assessment * Third party reports * Portfolio of evidence * Project * Practical |
| 1. Apply Problem-solving skills | * 1. Causes of problems   2. Methods of solving problems   3. Problem-solving process   4. Decision making   5. Creative thinking and critical thinking process in development of innovative and practical solutions | * Observation * Written assessment * Oral assessment * Third party reports * Portfolio of evidence * Project * Practical |
| 1. Promote Customer Care | * 1. Identifying customer needs   2. Qualities of good customer service   3. Customer feedback methods   4. Resolving customer concerns   5. Customer outreach programs   6. Customer retention | * Observation * Written assessment * Oral assessment * Third party reports * Portfolio of evidence * Project * Practical |

**Suggested Methods of Instruction**

* Instructor lead facilitation of theory using active learning strategies.
* Demonstrations
* Simulation/Role play
* Group Discussion
* Presentations
* Projects
* Case studies
* Assignments

**Recommended Resources for 30 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio (Item: Trainee)** |
| **A** | **Learning Materials** |  |  |  |
|  | Textbooks | Comprehensive texts books on Work Ethics and Practices | 30 pcs | 1:1 |
|  | PowerPoint Presentations | For trainer’s use, covering course content and practical applications | 1 | 1:30 |
|  | Projector | Functional projector for displaying content during presentations | 1 | 1:30 |
|  | Media Resources | This include but are not limited to:   * Video Clips * Audio Clips * TV Sets * Radio Sets |  |  |
|  | White board | Quality whiteboard of approximately 6 ft by 3 ft for writing during theory instruction | 1 | 1:30 |
| **B** | **Learning Facilities & Infrastructure** |  |  |  |
|  | Lecture/Theory Room  /Learning Resource  Area\* | Spacious, equipped with projectors and Seats for 30 trainees, approximately 45 sqm (5 m x 9 m) | 1 | 1:30 |
|  | Computer Laboratory | Equipped with at least 30 functional computers with internet connectivity and the following software:   * + - Windows/ Linux/ Macintosh Operating System     - Microsoft Office Software     - Google Workspace Account     - Antivirus Software | 30 | 1:1 |
|  |  |  |  |  |
| **C** | **Consumable Materials** |  |  |  |
|  | Printing Papers | A4 and A3 Printing papers suitable for the task | Enough |  |
|  | Flashcards | For carrying out various activities by trainees | Enough |  |
|  | Charts | Sufficient for group work activities and displaying | Enough |  |
|  | Whiteboard Marker Pens | Dry-erase markers for trainers use. Assorted colors | Enough |  |

**COMMON UNITS OF LEARNING**

**APPLIED MATHEMATICS**

**Unit Code: 0541 441 09A**

**Relationship with Occupational Standards**

This unit addresses the Unit of Competency: Apply Mathematics

**Unit Duration: 80 Hours**

**Unit Description**

This unit describes the competences required in order to Apply trigonometric functions, carrying out mensuration, Apply statistics and probability

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **S/No.** | **Learning Outcomes** | **Duration (Hours)** |
|  | Apply algebra | 20 |
|  | Apply trigonometric functions | 20 |
|  | Carry out mensuration | 20 |
|  | Apply statistics and probability | 20 |
| TOTAL | | 80 |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| * + - 1. Apply algebra | * 1. Indices      1. Power zero      2. Negative powers      3. Fractional powers      4. Laws of indices         1. Addition         2. Subtraction         3. Division         4. Multiplication   2. BODMAS   3. Roots      1. Square roots      2. Cube roots      3. nth roots   4. Logarithms      1. Laws of Logarithms         1. Product Law         2. Quotient Law         3. Power Law   5. Use of scientific calculator      1. Power ON/OFF      2. Mode         1. Degree         2. Radian         3. Gradient         4. SD      3. Clear      4. Save      5. Shift   6. Simultaneous equations   (up to 3 equations)   * + 1. Elimination     2. Substitution     3. Reduction     4. Graphical   1. Quadratic equations      1. Factorization      2. Quadratic formula      3. Completing the square      4. Graphical | * Written tests |
| * + - 1. Apply trigonometric functions | * 1. Angles      1. Acute      2. Obtuse      3. Reflex      4. Right angle   2. Triangles      1. Isosceles      2. Equilateral      3. Right angled      4. Scalene   3. Trigonometric Ratios      1. Sine      2. Cosine      3. Tangent      4. Cosecant      5. Secant      6. Cotangent   4. Trigonometric Identities      1. Proof of identities      2. Pythagorean identities   5. Solve trigonometric equations   6. Hyperbolic functions      1. Sinh x      2. Cosh x      3. Cosech x      4. Tanh x      5. Sech x | * Written tests |
| * + - 1. Carry out mensuration | * 1. Units and symbols of measurement      1. Mass      2. Distance      3. Speed      4. Temperature      5. Time   2. Imperial and metric units      1. Conversions   3. Perimeter      1. Regular shapes   4. Area      1. Regular shapes   5. Volume      1. Regular shapes | * Written tests |
| * + - 1. Apply statistics and probability | * 1. Data presentation      1. Continuous variables         1. Histogram         2. Line      2. Discrete variable         1. Bar graph         2. Pie graph      3. Grouped data         1. Histogram         2. Bar         3. Cumulative frequency         4. ogive      4. Ungrouped data         1. Line         2. Cumulative frequency   2. Measures of central tendency      1. Mean         1. Grouped data         2. Ungrouped data      2. Mode         1. Grouped data         2. Ungrouped data      3. Medium         1. Grouped data         2. Ungrouped data   3. Measures of dispersion      1. Standard deviation         1. Grouped data         2. Ungrouped data      2. Variance         1. Grouped data         2. Ungrouped data   4. Probability      1. With replacement      2. Without replacement   5. Probability distribution functions      1. Binomial distribution      2. Poisson distribution   6. Normal distribution | * Written tests |

**Suggested Delivery Methods**

* Demonstration
* Group discussions
* Exercises
* Online materials
* Direct instructions
* Simulation

**Recommended Resources for 30 trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio (Item: Trainee)** |
| **A** | **Learning Materials** | | | |
|  | Textbooks | Comprehensive textbooks on Engineering Mathematics | 30 | 1:1 |
|  | Graph books | For graphical representation of solutions | 30 | 1:1 |
|  | Projector | Functional projector for displaying content during presentations | 1 | 1:30 |
|  | Computer | Functional desktop computer with online instructional content | 1 | 1:30 |
|  | White board | Quality whiteboard of approximately 6 ft by 3 ft for writing during theory instruction | 1 | 1:30 |
|  | Printer | An ink-jet, laser-jet or toner-cartridge printer for printing notes, instructions and working drawings | 1 | 1:30 |
| **B** | **Learning Facilities & Infrastructure** | | | |
|  | Lecture/Theory Room | Spacious room with seats for 25 trainees, approximately 60 sqm | 1 | 1:30 |
| **C** | **Materials and Supplies** | | | |
|  | First Aid kit | Fully equipped First Aid kit for use in case of accidents | 1 | 1:30 |
| **D** | **Tools and Equipment** | | | |
|  | Set of Mathematical instruments | For constructions and measurements | 30 | 1:1 |
|  | Scientific Calculator | For Calculations | 30 | 1:1 |
|  | Firefighting extinguishers | Water, carbon dioxide and chemical powder fire extinguishers for fire fighting | 1 | 1:30 |
| **E** | **Reference Materials** | | | |
|  | Training Presentations/Slides | Digital format for shared access among trainees | 1 | 1:30 |
|  | Standard Mathematical Tables | For reference on formulae, identities, laws and principles | 30 | 1:1 |

**TECHNICAL DRAWING**

**UNIT CODE: 0732 451 10A**

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply technical drawings

**Duration of Unit:** 80 Hours

**Unit Description**

This unit covers the competences required to apply technical drawings. It involves using technical drawing tools, equipment and materials, producing plane geometry drawings, orthographic drawings of components, solid geometry drawings, isometric drawings and assembly drawings.

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **S/No.** | **Learning Outcomes** | **Duration (Hours)** |
|  | Use technical drawing tools, equipment and materials | 10 |
|  | Produce plane geometry drawings | 10 |
|  | Produce orthographic drawings of components | 20 |
|  | Produce solid geometry drawings | 10 |
|  | Produce Isometric drawings | 20 |
|  | Produce assembly drawings | 10 |
| TOTAL | | 80 |

**Learning Outcomes, Content and Suggested Assessment Methods:**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Use and maintain drawing equipment and materials | * 1. Drawing equipment      1. T square      2. Set square      3. Protractor      4. Engineering drawing set   2. Drawing materials      1. Drawing papers      2. Masking tape      3. Clips      4. Drawing board      5. Clutch pencils   3. Use and maintenance of drawing equipment | * Practical Tests * Written tests |
| 1. Produce plane geometry drawings | * 1. Types of lines in drawings      1. Boarder lines      2. Faint continuous lines      3. Broken lines      4. Chain lines      5. Centre lines      6. Cutting lines   2. Construction of angles      1. Acute angles      2. Right angles      3. Reflex angles      4. Obtuse angles      5. Straight angles   3. Bisection of angles      1. Acute angles      2. Right angles      3. Reflex angles      4. Obtuse angles   4. Measurement of angles      1. Acute angles      2. Right angles      3. Reflex angles      4. Obtuse angles      5. Straight angles   5. Construction of plane geometric forms      1. Triangles      2. Quadrilaterals      3. Polygons      4. Circles and tangents   6. Construction of scales      1. Plane scales      2. Diagonal scale      3. Reducing and enlargement scales | * Practical tests * Written Tests |
| 1. Produce orthographic drawings of components | * 1. Orthographic drawings      1. First angle projection      2. Third angle projection   2. Dimensioning   3. Sectional views   4. Free hand sketches      1. Geometric forms      2. Tools      3. Equipment      4. Mechanical components | * Practical tests * Written Tests |
| 1. Produce solid geometry drawings | * 1. Sketches and drawings of patterns      1. Cylinders      2. Prisms      3. pyramids   2. solids drawings      1. Prisms      2. Cones      3. Cylinders   3. Development and interpenetrations of solids      1. cylinder to cylinder      2. cylinder to prisms      3. prism to prism   4. Different symbols and abbreviations   5. Auxiliary views and true shapes of truncated solids      1. Truncated cylinder      2. Truncated prism      3. Truncated pyramid | * Practical tests * Written Tests |
| 1. Produce isometric drawings | * 1. Isometric sketches and drawings of components   2. Isometric curves and circles   3. Oblique sketches of components | * Practical tests * Written Tests |
| 1. Produce assembly drawings | * 1. Orthographic views of assembly drawings      1. First angle projection      2. Third angle projection   2. Sectional views   3. Parts list | * Practical tests * Written Tests |

**Suggested Methods of Delivery**

* Projects
* Demonstration by trainer
* Practice by the trainee
* Discussions

**Recommended Resources for 25 trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio (Item: Trainee)** |
| **A** | **Learning Materials** |  |  |  |
|  | Textbooks | Comprehensive texts books on Technical Drawing | 25 pcs | 1:1 |
|  | PowerPoint Presentations | For trainer’s use, covering course content and practical applications | 1 | 1:25 |
|  | Working drawings | Working drawings giving a detailed overview of the task at hand |  |  |
|  | Projector | Functional projector for displaying content during presentations | 1 | 1:25 |
|  | White board | Quality whiteboard of approximately 6 ft by 3 ft for writing during theory instruction | 1 | 1:25 |
| **B** | **Learning Facilities & Infrastructure** |  |  |  |
|  | Drawing Room  /Learning Resource  Area\* | Spacious, equipped with a projector and drawing tables for 25 trainees, approximately 45 sqm (5 m x 9 m) | 1 | 1:25 |
| **C** | **Consumable Materials** |  |  |  |
|  | Drawing papers | A4, A3 and A2 size drawing papers for drafting of sketches and working drawings | 1 ream | 1:25 |
|  | Drawing Pencils | For drawing   * HB * 2H/3H * 2B | Enough |  |
|  | Eraser | Dustless eraser for pencil stains | 30 |  |
|  | Masking Tape | For attaching the drawing paper to the drawing board | Enough |  |
| **D** | **Tools and Equipment** |  |  |  |
|  | Drawing Instruments | The include:   * T-squares * 30-60 degree set squares * 45 degree set square * Protractor * Compass set | 25 sets | 1:1 |
|  | Pencil Sharpener | For creating sharp pencil tips | 25 pcs | 1:1 |
|  | Drawing Tables | For drawing | 25 pcs | 1:1 |
| **E** | **Reference Materials** |  |  |  |
|  | Welding /blueprint /drawing Standards | Reference on industry standards (e.g., BS/ANSI/AWS etc) | 5 pcs | 1:5 |
|  | Multimedia Learning Modules | Videos and tutorials | 25 pcs | 1:1 |

**CORE UNITS OF LEARNING**

# VEHICLE GLASS COMPONENTS INSTALLATION

**ISCED UNIT CODE**: 0716 451 11A

Relationship to occupational standards

This unit addresses the unit of competency: Install Vehicle Glass Components

Duration of unit: 120 Hours

UNIT DESCRIPTION:

This unit of learning covers the learning outcomes, content, assessment methods, methods of delivery and resources required to train install vehicle glass components.

It involves installing vehicle glass components, preparing vehicle glass component, fitting vehicle glass components and performing housekeeping.

Summary of Learning Outcomes

By the end of this unit of learning, the trainee will be able to:

|  |  |  |
| --- | --- | --- |
| **S/No.** | **Learning Outcome** | **Duration (Hours)** |
|  | Prepare vehicle glass component | 50 |
|  | Fit vehicle glass components | 50 |
|  | Perform House Keeping | 20 |
| **Total** | | 120 |

Learning Outcomes, Content and Suggested Assessment Methods

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Prepare vehicle glass component | |  |  | | --- | --- | |  | * 1. Usage of personal protective equipment (PPE):      1. Gloves      2. Goggles      3. Dust masks   2. Tools and materials:  1. Glass cutters    * 1. Steel Wheel Cutter      2. Tungsten Carbide Wheel Cutter      3. Pistol-Grip Glass Cutter      4. Pencil-Style Glass Cutter      5. Self-Lubricating Glass Cutter      6. Circle Glass Cutter      7. Running Pliers with Cutting Attachment      8. Multi-Wheel Glass Cutter      9. Electric Diamond Cutter      10. Adhesive applicators          1. Hot Glue Gun          2. Caulking Gun          3. Spray Adhesive Applicator          4. Tape Dispenser          5. Double-Sided Tape Applicator          6. Bottle Applicator with Precision Tip          7. Adhesive Roller          8. Syringe Adhesive Dispenser          9. Glue Stick Applicator      11. Suction lifters 2. Lever-Activated Suction Lifter 3. Single-Cup Suction Lifter 4. Double-Cup Suction Lifter 5. Triple-Cup Suction Lifter 6. Pump-Action Suction Lifter    * 1. Glass panels         1. Windshields         2. Side windows         3. Rear windows         4. Roof glass         5. Specialty glass      2. Reflective components 7. Side mirrors 8. Rearview mirrors 9. Headlight reflectors    * 1. Screwdrivers and torque wrenches      2. Rubber mallets      3. Primer and bonding agents      4. Protective film      5. Calibrating devices    1. Inspection of glass sheets:   1.3.1 Checking for cracks  1.3.2 Ensuring surface clarity   * 1. Marking out dimensions:   2. Measuring and marking glass as per specifications      1. Measuring Tools      2. Measuring tape      3. straight edge rulers   1.5 Cutting and smoothing:  1.5.1 Using cutting tools for precise edges  1.5.2 Smoothing edges for safety | |  |  | | * Practical * Projects * Portfolio of evidence * Written tests |
| 1. Fit vehicle glass components | * 1. Work area organization  1. Workplace cleaning 2. Safety signs and barriers set up 3. Tools and materials arrangement    1. Tools and Materials Selection       1. Suction lifters       2. Adhesive applicators       3. Alignment tools    2. Glass components alignment. 4. Glass adjustment to vehicle body panels 5. Alignment checking    1. Seals and adhesives selection. 6. Seals and gaskets inspection 7. Adhesive choice    1. Adhesives application. 8. Cleaning and priming 9. Adhesive application    1. Glass components positioning and fitting 10. Lifting and positioning glass 11. Securing mounting points     1. Fitment testing 12. Water leakage tests | * Practical * Project * Written assessment * Oral assessment * Portfolio of evidence |
| 1. Perform House Keeping | * 1. Waste Disposal and Management.  1. Material recycling and segregation 2. Hazardous waste disposal    1. Tools and Equipment 3. Cleaning tools 4. Tools and equipment storage    1. Cleaning the workshop | * Practical * Project * Written assessment * Oral assessment |

**Suggested Methods of Instruction**

* Practical
* Project Work
* Demonstrations
* Direct instruction with active learning strategies
* Group Discussions
* Demonstration

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S/No. | Category/Item | Description/ Specifications | Quantity | Recommended Ratio  (Item: Trainee) |
| A | Learning materials and infrastructure | | | |
|  | Training Classes: 1 session | 8M\*20M | 1 | 1:25 |
|  | Workshops: 1 practical workshop | 18M\*12M | 1 | 1:25 |
|  | Computer |  | 1 | 1:25 |
|  | Projector for presentations |  | 1 | 1:25 |
|  | Whiteboard for collaborative learning | 4 ft by 8 ft | 1 | 1:25 |
|  | Access to Internet |  |  |  |
|  | Textbooks | Textbooks on auto glazing | 5 pcs | 1:5 |
| B | Tools and Equipment | | | |
|  | Glass Cutters Set | Including various types (Steel Wheel, Tungsten Carbide, etc.) | 5 | 1:5 |
|  | Adhesive Applicators Set | Including caulking guns, precision tips | 5 | 1:5 |
|  | Suction Lifters Set | Various cup configurations | 5 | 1:5 |
|  | Screwdriver Sets | Various sizes | 5 | 1:5 |
|  | Torque Wrenches | Calibrated | 5 | 1:5 |
|  | Rubber Mallets |  | 5 | 1:5 |
|  | Measuring Tools Set | Including tapes and straight edges | 5 | 1:5 |
|  | Calibrating Devices | For ADAS systems | 2 | 1:13 |
|  | Tool Storage Systems |  | 3 | 1:8 |
|  | Alignment Tools Set |  | 5 | 1:5 |
|  | Water Testing Equipment | For leak testing | 2 | 1:13 |
|  | Cleaning Kits for Tools and Equipment |  | 10 | 1:3 |
|  | Floor Cleaning Kits (mops, brooms) |  | 5 | 1:5 |
| C | Materials | | | |
|  | Glass Panels | Practice pieces of various types | 10 | 1:3 |
|  | Primer Sets | For different glass types | 5 | 1:5 |
|  | Bonding Agents | Various types | 5 | 1:5 |
|  | Protective Films | Various sizes | 25 | 1:1 |
|  | Seals and Gaskets | Various types and sizes | 10 | 1:3 |
|  | Practice Mirrors | Side and rearview | 10 | 1:3 |
| D | Safety Equipment | | | |
|  | Safety Glasses |  | 25 | 1:1 |
|  | Work Gloves | Various sizes | 25 | 1:1 |
|  | Dust Masks |  | 25 | 1:1 |
| E | Cleaning Supplies | | | |
|  | Glass Cleaners |  | 5 | 1:5 |
|  | Surface Preparation Materials |  | 5 | 1:5 |
|  | Cleaning Cloths | Lint-free | 25 | 1:1 |
| F | Waste Management | | | |
|  | Glass Recycling Bins |  | 2 | 1:13 |
|  | Hazardous Waste Containers | For adhesives and primers | 2 | 1:13 |
|  | General Waste Bins |  | 3 | 1:8 |
|  | Glass Panels | Practice pieces of various types | 10 | 1:3 |

# GLAZING FINISHING PROCESSES

**ISCED UNIT CODE:** 0716 451 12A

**Relationship to occupational standards**

**This unit addresses the unit of competency:** Perform Glazing Finishing Processing

Duration of unit: 120 Hours

**Unit Description:**

This unit of learning covers the learning outcomes, content, assessment methods, methods of delivery and resources required to train perform glazing finishing processing. It involves competencies in clean glass surfaces, polish glass surface, install attachments and performing housekeeping.

**Summary of Learning Outcomes**

By the end of this unit of learning, the trainee will be able to:

|  |  |  |
| --- | --- | --- |
| **S/No.** | **Learning Outcome** | **Duration (Hours)** |
|  | Inspect Vehicle Glass Components | 30 |
|  | Polish glass surface | 30 |
|  | Install attachments | 40 |
|  | Perform House Keeping | 20 |
| **Total** | | 120 |

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Inspect Vehicle Glass Components | * 1. Workplace preparation.  1. Cleaning and clearing 2. Tools arrangement and selection    * + 1. Microfiber cloths        2. Sponges        3. Soft-bristle brushes        4. Soft-bristle brushes      1. cleaning agents selection         1. Adhesive removers         2. Degreasers         3. Scratch-removal         4. polishing pastes         5. UV glass cleaner         6. Rain repellent solutions    1. Glass surfaces inspection and cleaning.       1. Glass examination 3. Dirt 4. Smudges 5. Residues    * 1. Cleaning agents application      2. Glass surface cleaning    1. Special contaminants removal   1.3.1 Use of specialized agents | * Practical * Project * Written assessment * Oral assessment |
| 1. Polish glass surface | 1. Work area preparation. 2. Arrange polishing tools 3. Glass polishing machines 4. Buffing pads and discs 5. Hand-held polishing blocks 6. Glass surfaces polishing. 7. Perform polishing 8. Restore clarity and smoothness. 9. Clean polished surfaces 10. Removal of residue | * Observation * Project * Written assessment * Oral assessment |
| 1. Install attachments | 1. Organize and prepare the work area. 2. Clean and clear the workspace. 3. Arrange tools and materials 4. Inspect glass mounting areas. 5. Mounting areas    * + 1. Windshields        2. Side Windows        3. Rear Windows        4. Sunroofs        5. Moonroofs        6. Rear-View Mirrors        7. Dashboard Mounts        8. Roof Mounts    1. Mounting area check       1. Dirt,       2. Misalignment       3. Damage.    2. Compatibility of attachments 6. Sensors 7. Cameras, 8. Heating elements 9. Wipers. 10. Window mechanism     1. Installation of attachments   3 5.1 Sensors  3.5.2 Cameras,  3.5.3 Heating elements  3.5.4 Wipers.  3.5.5 Window mechanism   * 1. Electrical connections testing   2. Final inspection. | * Observation * Project * Written assessment * Oral assessment |
| 1. Perform House Keeping | * 1. Waste Disposal and Management.      1. Recycling and segregating materials   2. Disposing hazardous waste   3. Tools and Equipment      1. Cleaning tools   4. Storing tools and equipment   5. Cleaning the workshop | * Observation * Project * Written assessment * Oral assessment |

**Suggested Methods of Instruction**

* Practical
* Project Work
* Demonstrations
* Direct instruction with active learning strategies
* Group Discussions
* Demonstration

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S/No. | Category/Item | Description/ Specifications | Quantity | Recommended Ratio  (Item: Trainee) |
| **A** | **Learning materials and infrastructure** | | | |
|  | Training Classes: 1 session | 8M\*20M | 1 | 1:25 |
| 2. | Workshops: 1 practical workshop | 18M\*12M | 1 | 1:25 |
| 3. | Computer |  | 1 | 1:25 |
| 4. | Projector for presentations |  | 1 | 1:25 |
| 5. | Whiteboard for collaborative learning | 4 ft by 8 ft | 1 | 1:25 |
| 6. | Access to Internet |  | 1 | 1:25 |
| 7. | Textbooks | Textbooks on glazing finishing | 5 pcs | 1:5 |
| **B** | **Tools and Equipment** | | | |
|  | **Cleaning Equipment** | | | |
| 1. | Professional Microfiber Cloths Set | Various sizes | 25 | 1:1 |
| 2. | Soft-bristle Brushes Set | Various sizes | 5 | 1:5 |
| 3. | Professional Sponges | Special glass cleaning | 10 | 1:3 |
|  | **Polishing Equipment** | | | |
| 1. | Glass Polishing Machines | Professional grade | 5 | 1:5 |
| 2. | Buffing Pads Set | Various grades | 10 | 1:3 |
| 3. | Hand-held Polishing Blocks |  | 10 | 1:3 |
|  | **Installation Tools** | | | |
| 1. | Sensor Calibration Tools | Professional grade | 2 | 1:13 |
| 2. | Electrical Testing Equipment | Multimeters etc. | 5 | 1:5 |
| 3. | Precision Screwdriver Sets | Various sizes | 5 | 1:5 |
|  | Measuring Tools | | | |
| 1. | Digital Multimeters | For electrical testing | 5 | 1:5 |
| **C** | **Materials** | | | |
| 1 | Cleaning Agents |  |  |  |
|  | Professional Glass Cleaners |  | 10 | 1:3 |
|  | Adhesive Removers | Professional grade | 5 | 1:5 |
|  | Degreasers |  | 5 | 1:5 |
|  | UV Glass Cleaners |  | 5 | 1:5 |
|  | Rain Repellent Solutions |  | 5 | 1:5 |
|  | **Polishing Materials** | | | |
|  | Polishing Compounds | Various grades | 10 | 1:3 |
|  | Scratch Removal Kits | Professional grade | 5 | 1:5 |
|  | Polishing Pastes | Various types | 10 | 1:3 |
|  | **Attachment Components** | | | |
| 1. | Practice Sensors | Various types | 5 | 1:5 |
| 2. | Practice Cameras | Various types | 5 | 1:5 |
| 3. | Heating Elements | For practice | 5 | 1:5 |
| 4. | Wiper Mechanisms | For practice | 5 | 1:5 |
| 5. | Window Mechanisms | For practice | 5 | 1:5 |
|  | **Safety Equipment** | | | |
| 1. | Safety Glasses | UV protected | 25 | 1:1 |
| 2. | Work Gloves | Chemical resistant | 25 | 1:1 |
| 3. | Dust Masks |  | 25 | 1:1 |
| 3. | Chemical-resistant Aprons |  | 25 | 1:1 |
|  | **Waste Management** | | | |
| 1. | Chemical Waste Containers | For cleaning agents | 2 | 1:13 |
| 2. | Recyclable Materials Bins |  | 2 | 1:13 |
| 3. | General Waste Bins |  | 3 | 1:8 |
|  | **Storage Solutions** | | | |
| 1. | Tool Cabinets | Organized storage | 3 | 1:8 |
| 2. | Chemical Storage Cabinet | Ventilated | 1 | 1:25 |
| 3. | Attachment Storage Systems |  | 2 | 1:13 |

# 

# MODULE IV

# BASIC UNITS OF LEARNING

**DIGITAL LITERACY**

**ISCED UNIT CODE:** **0611 441 13A**

**Relationship with Occupational Standards**

This unit addresses the Unit of Competency: Apply Digital Literacy

**Duration of Unit:** **40 Hours**

**Unit Description**

This unit covers the competencies required to demonstrate digital literacy. It involves operating computer devices, solving tasks using the Office suite, managing data and information, performing online communication and collaboration, applying cybersecurity skills and job entry techniques, and performing jobs online.

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **S/No.** | **Learning Outcomes** | **Duration (Hours)** |
|  | Operate Computer Devices | 6 |
|  | Solve Tasks Using Office Suite | 14 |
|  | Manage Data and Information | 6 |
|  | Perform Online Communication and Collaborations | 4 |
|  | Apply Cybersecurity Skills | 4 |
|  | Perform Online Jobs | 4 |
|  | Apply job entry techniques. | 2 |
|  | | 40 |

**Learning Outcomes, Content, and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
| --- | --- | --- |
| * + 1. Operate computer devices | * 1. Meaning and importance of digital literacy   2. Functions and Uses of Computers   3. Classification of computers   4. Components of a computer system   5. Computer Hardware      1. The System Unit E.g. Motherboard, CPU, casing      2. Input Devices e.g. Pointing, keying, scanning, voice/speech recognition, direct data capture devices.      3. Output Devices e.g. hardcopy output and softcopy output      4. Storage Devices e.g. main memory e.g. RAM, secondary storage (Solid state devices, Hard Drives, CDs & DVDs, Memory cards, Flash drives      5. Computer Ports e.g. HDMI, DVI, VGA, USB type C etc.   6. Classification of computer software   7. Operating system functions   8. Procedure for turning/off a computer   9. Mouse use techniques   10. Keyboard Parts and Use Techniques   11. Desktop Customization   12. File and Files Management using an operating system   13. Computer Internet Connection Options       1. Mobile Networks/Data Plans       2. Wireless Hotspots       3. Cabled (Ethernet/Fiber)       4. Dial-Up       5. Satellite   14. Computer external devices management       1. Device connections       2. Device controls (volume controls and display properties) | * Observation * Written assessment * Oral assessment * Practical assessment |
| * + 1. Solve tasks using Office suite | * 1. Meaning and Importance of Word Processing   2. Examples of Word Processors   3. Working with word documents      1. Open and close word processor      2. Create a new document      3. Save a document      4. Switch between open documents   4. Enhancing productivity      1. Set basic options/preferences      2. Help resources      3. Use magnification/zoom tools      4. Display, hide built-in tool bar      5. Using navigation tools   5. Typing Text   6. Document editing (copy, cut, paste commands, spelling and Grammar check)   7. Document formatting      1. Formatting text      2. Formatting paragraph      3. Formatting styles      4. Alignment      5. Creating tables      6. Formatting tables   8. Graphical objects      1. Insert object (picture, drawn object)      2. Select an object      3. Edit an object      4. Format an object   9. Document Print setup      1. Page layout,      2. Margins set up      3. Orientation.   10. Word Document Printing   11. Meaning & Importance of electronic spreadsheets   12. Components of Spreadsheets   13. Application areas of spreadsheets   14. Using spreadsheet application       1. Parts of Excel screen: ribbon, formula bar, active cell, name box, column letter, row number, Quick Access Toolbar.       2. Cell Data Types       3. Block operations       4. Arithmetic operators (formula bar (-, +, \*, /).       5. Cell Referencing   15. Data Manipulation       1. Using Functions (Sum, Average, SumIF, Count, Max, Max, IF, Rank, Product, mode etc)       2. Using Formulae       3. Sorting data       4. Filtering data       5. Visual representation using charts   16. Worksheet printing   17. Electronic Presentations   18. Meaning and Importance of electronic presentations   19. Examples of Presentation Software   20. Using the electronic presentation application       1. Parts of the PowerPoint screen (slide navigation pane, slide pane, notes, the ribbon, quick access toolbar, and scroll bars).       2. Open and close presentations       3. Creating Slides (Insert new slides, duplicate, or reuse slides.)       4. Text Management (insert, delete, copy, cut and paste, drag and drop, format, and use spell check).       5. Use magnification/zoom tools       6. Apply or change a theme.       7. Save a presentation       8. Switch between open presentations   21. Developing a presentation       1. Presentation views       2. Slides       3. Master slide   22. Text       1. Editing text       2. Formatting       3. Tables   23. Charts       1. Using charts       2. Organization charts   24. Graphical objects       1. Insert, manipulate       2. Drawings   25. Prepare outputs       1. Applying slide effects and transitions       2. Check and deliver          1. Spell check a presentation          2. Slide orientation          3. Slide shows, navigation   26. Print presentations (slides and handouts) | * Observation * Portfolio of Evidence * Project * Written assessment * Practical assessment * Oral assessment |
| * + 1. Manage Data and Information | * 1. Meaning of Data and information   2. Importance and Uses of data and information   3. Types of internet services      1. Communication Services      2. Information Retrieval Services      3. File Transfer      4. World Wide Web Services      5. Web Services      6. Automatic Network Address Configuration      7. News Group      8. Ecommerce   4. Types of Internet Access Applications   5. Web browsing concepts      1. Key concepts      2. Security and safety   6. Web browsing      1. Using the web browser      2. Tools and settings      3. Clearing Cache and cookies      4. URIs      5. Bookmarks      6. Web outputs   7. Web based information      1. Search      2. Critical evaluation of information      3. Copyright, data protection   8. Downloads Management   9. Performing Digital Data Backup (Online and Offline)   10. Emerging issues in internet | * Observation * Portfolio of Evidence * Project * Written assessment * Practical assessment * Oral assessment |
| * + 1. Perform online communication and collaboration | * 1. Netiquette principles   2. Communication concepts      1. Online communities      2. Communication tools      3. Email concepts   3. Using email      1. Sending email      2. Receiving email      3. Tools and settings      4. Organizing email   4. Digital content copyright and licenses   5. Online collaboration tools      1. Online Storage (Google Drive)      2. Online productivity applications (Google Docs & Forms)      3. Online meetings (Google Meet/Zoom)      4. Online learning environments      5. Online calendars (Google Calendars)      6. Social networks (Facebook/Twitter - Settings & Privacy)   6. Preparation for online collaboration      1. Common setup features      2. Setup   7. Mobile collaboration      1. Key concepts      2. Using mobile devices      3. Applications      4. Synchronization | * Observation * Portfolio of Evidence * Project * Written assessment * Practical assessment * Oral assessment |
| * + 1. Apply cybersecurity skills | * 1. Data protection and privacy      1. Confidentiality of data/information      2. Integrity of data/information      3. Availability of data/information   2. Internet security threats      1. Malware attacks      2. Social engineering attacks      3. Distributed denial of service (DDoS)      4. Man-in-the-middle attack (MitM)      5. Password attacks      6. IoT Attacks      7. [Phishing Attacks](https://onlinedegrees.sandiego.edu/top-cyber-security-threats/#phishing-attacks)      8. [Ransomware](https://onlinedegrees.sandiego.edu/top-cyber-security-threats/#ransomware)   3. Computer threats and crimes   4. Cybersecurity control measures      1. Physical Controls      2. Technical/Logical Controls (Passwords, PINs, Biometrics)      3. Operational Controls   5. Laws governing protection of ICT in Kenya      1. The Computer Misuse and Cybercrimes Act No. 5 of 2018      2. The Data Protection Act No. 24 Of 2019 | * Observation * Portfolio of Evidence * Project * Written assessment * Practical assessment * Oral assessment |
| * + 1. Perform Online Jobs | * 1. Introduction to online working   2. Types of online Jobs   3. Online job platforms      1. Remotask      2. Data annotation tech      3. Cloud worker      4. Upwork      5. Oneforma      6. Appen   4. Online account and profile management   5. Identifying online jobs/job bidding   6. Online digital identity   7. Executing online tasks   8. Management of online payment accounts. | * Observation * Portfolio of Evidence * Project * Written assessment * Practical assessment * Oral assessment |
| * + 1. Apply job entry techniques | * 1. Types of job opportunities      1. Self-employment      2. Service provision      3. product development      4. salaried employment         1. Sources of job opportunities   2. Resume/curriculum vitae      1. What is a CV      2. How long should a CV be      3. What to include in a CV      4. Format of CV      5. How to write a good CV      6. Don’ts of writing a CV   3. Job application letter      1. What to include      2. Addressing a cover letter      3. Signing off a cover letter   4. Portfolio of Evidence      1. Academic credentials      2. Letters of commendations      3. Certification of participations      4. Awards and decorations   5. Interview skills      1. Listening skills      2. Grooming      3. Language command      4. Articulation of issues      5. Body language      6. Time management      7. Honesty   6. Generally knowledgeable in current affairs and technical area | * + Observation   + Oral assessment   + Portfolio of evidence   + Third party report * Written assessment |

**Suggested Methods Instruction**

* + Instructor-led facilitation using active learning strategies
  + Demonstration by trainer
  + Practical work by trainees
  + Viewing of related videos
  + Group discussions
  + Project
  + Role play
  + Case study

**Recommended Resources for 30 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio (Item: Trainee)** |
| **A** | **Learning Materials** |  |  |  |
|  | Textbooks | Comprehensive texts books on Digital Literacy | 30 pcs | 1:1 |
|  | Installation Manuals | Detailed guides for equipment and software installation and troubleshooting | 5 pcs | 1:5 |
|  | PowerPoint Presentations | For trainer’s use, covering course content and practical applications | 1 | 1:30 |
|  | Projector | Functional projector for displaying content during presentations | 1 | 1:30 |
|  | White board | Quality whiteboard of approximately 6 ft by 3 ft for writing during theory instruction | 1 | 1:30 |
|  | Printer | An ink-jet, laser-jet or toner-cartridge printer for printing notes, instructions and working drawings | 1 | 1:30 |
|  | Templates | Templates for creating various documents e.g. CV, Cover Letter, etc. | 30 | 1:1 |
| **B** | **Learning Facilities & Infrastructure** |  |  |  |
|  | Lecture/Theory Room  /Learning Resource  Area\* | Spacious, equipped with projectors and Seats for 30 trainees, approximately 45 sqm (5 m x 9 m) | 1 | 1:30 |
|  | Computer Laboratory | Equipped with at least 30 functional computers with internet connectivity and the following software:   * + - Windows/ Linux/ Macintosh Operating System     - Microsoft Office Software     - Google Workspace Account     - Antivirus Software | 30 | 1:1 |
| **C** | **Consumable Materials** |  |  |  |
|  | Printing Papers | A4 and A3 Printing papers suitable for the task | Enough |  |
|  | Whiteboard Marker Pens | Dry-erase markers for trainers use. Assorted colors | Enough |  |
|  | Storage devices | Any of the following storage devices:   * USB Flash Drive * USB Hard Drive * Compact Disks (CDs) * Digital Versatile Disks (DVDs) | Enough |  |

**ENTREPRENEURIAL SKILLS**

**ISCED UNIT CODE: 0413 441 14A**

**Relationship with occupational standards**

This unit addresses the unit of competency: Apply Entrepreneurial skills.

**Duration of unit: 40 Hours**

**Unit Description:**

This unit covers the competencies required to demonstrate an understanding of entrepreneurship. It involves demonstrating an understanding of financial literacy, applying entrepreneurial concepts identifying entrepreneurship opportunities, applying business legal aspects, and developing business innovative strategies and business plans.

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **S/No.** | **Learning Outcomes** | **Duration (Hours)** |
|  | Apply financial literacy | 6 |
|  | Apply the entrepreneurial concept | 4 |
|  | Identify entrepreneurship opportunities | 6 |
|  | Apply business legal aspects | 6 |
|  | Innovate Business Strategies | 6 |
|  | Develop business plan | 12 |
| TOTAL | | 40 |

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Apply financial literacy | * 1. Personal finance management   2. Balancing between needs and wants   3. Budget Preparation   4. Saving management   5. Factors to consider when deciding where to save   6. Debt management   7. Factors to consider before taking a loan   8. Investment decisions   9. Types of investments   10. Factors to consider when investing money   11. Insurance services   12. insurance products available in the market   13. Insurable risks | * Observation * Project * Written assessment * Oral assessment * Third party report * Interviews |
| 1. Apply entrepreneurial concept | * 1. Difference between Entrepreneurs and Business persons   2. Types of entrepreneurs   3. Ways of becoming an entrepreneur   4. Characteristics of Entrepreneurs   5. salaried employment and self-employment   6. Requirements for entry into self-employment   7. Roles of an Entrepreneur in an enterprise   8. Contributions of Entrepreneurship | * Observation * Project * Written assessment * Oral assessment * Third party report |
| 1. Identify entrepreneurship opportunities | * 1. Sources of business ideas   2. Factors to consider when evaluating business opportunity   3. Business life cycle | * Observation * Project * Written assessment * Oral assessment * Third party report |
| 1. Apply business legal aspects | * 1. Forms of business ownership   2. Business registration and licensing processing   3. Types of contracts and agreements   4. Employment laws   5. Taxation laws | * Observation * Project * Written assessment * Oral assessment * Third party report |
| 1. Innovate business Strategies | * 1. Creativity in business   2. Innovative business strategies   3. Entrepreneurial Linkages   4. ICT in business growth and development | * Observation * Project * Written assessment * Oral assessment * Third party report |
| 1. Develop Business Plan | * 1. Business description   2. Marketing plan   3. Organizational/Management   4. plan   5. Production/operation plan   6. Financial plan   7. Executive summary   8. Business plan presentation   9. Business idea incubation | * Observation * Written assessment * Project * Oral assessment * Third party report |

**Suggested Methods of Instruction**

* Direct instruction with active learning strategies
* Project (Business plan)
* Case studies
* Field trips
* Group Discussions
* Demonstration
* Question and answer
* Problem solving
* Experiential
* Team training
* Guest speakers

**Recommended Resources for 30 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio (Item: Trainee)** |
| **A** | **Learning Materials** |  |  |  |
|  | Textbooks | Comprehensive texts books on Entrepreneurial Skills | 30 pcs | 1:1 |
|  | PowerPoint Presentations | For trainer’s use, covering course content and practical applications | 1 | 1:30 |
|  | Projector | Functional projector for displaying content during presentations | 1 | 1:30 |
|  | Media Resources | These include but are not limited to:   * Video Clips * Audio Clips * TV Sets * Radio Sets * Newspapers * Business Journals * Case studies |  |  |
|  | Templates | Templates for creating various documents e.g. business plan, invoices etc. | 30 | 1:1 |
|  | White board | Quality whiteboard of approximately 6 ft by 3 ft for writing during theory instruction | 1 | 1:30 |
| **B** | **Learning Facilities & Infrastructure** |  |  |  |
|  | Lecture/Theory Room  /Learning Resource  Area\* | Spacious, equipped with projectors and Seats for 30 trainees, approximately 45 sqm (5 m x 9 m) | 1 | 1:30 |
|  | Computer Laboratory | Equipped with at least 15 functional computers with internet connectivity and the following software:   * + - Windows/ Linux/ Macintosh Operating System     - Microsoft Office Software     - Google Workspace Account     - Antivirus Software | 1 | 1:1 |
| **C** | **Consumable Materials** |  |  |  |
|  | Writing Materials | Writing materials for note taking | Enough |  |
|  | Flashcards | For carrying out various activities by trainees | Enough |  |
|  | Charts | Sufficient for group work activities and displaying | Enough |  |
|  | Whiteboard Marker Pens | Dry-erase markers for trainers use. Assorted colours | Enough |  |

**COMMON UNITS OF LEARNING**

**WORKSHOP TECHNOLOGY**

**UNIT CODE: 0715 451 15A**

**Relationship with Occupational Standards:**

This unit addresses the unit of competency: Apply workshop technology

**Duration of Unit:** 80 Hours

**Unit description**

This unit describes the competencies required by a technician in order to apply workshop practice in their work. It includes applying workshop safety, material science principles and workshop tools and equipment. It also includes performing material preservation and house keeping

**Summary of Learning Outcome**

|  |  |  |
| --- | --- | --- |
| **S/No.** | **Learning Outcomes** | **Duration (Hours)** |
|  | Apply workshop safety | 10 |
|  | Apply material science principles | 10 |
|  | Apply workshop tools and equipment | 30 |
|  | Perform material preservation | 20 |
|  | Perform housekeeping | 10 |
|  | | 80 |

**Learning Outcomes, Content and suggested assessment methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Apply workshop safety | * 1. Workshop safety      1. Definition      2. Types and uses of PPE’s   2. Emergence responses steps      1. Common emergencies         1. Fire         2. Chemical spills         3. Injury response   3. Fire safety      1. Fire extinguishers types and uses      2. Flammable materials identification      3. Fire prevention   4. Safe handling and disposal of chemicals and materials      1. Chemical hazard identification      2. Safe handling procedure      3. Storage and labelling of chemicals      4. Chemical disposal procedures      5. Emergency response for chemical exposure   5. Identifying and marking hazardous zones      1. Common hazardous zones         1. Flammable zones         2. High traffic zones         3. Electrical hazard zones         4. Chemical storage areas   6. Work area organization and maintenance      1. Setting up      2. Proper storage and labelling of tools and equipment   7. Workplace hazards and risks      1. Physical hazards         1. Noises         2. Vibration         3. Heat         4. Sharp object      2. Chemical hazards         1. Fuels         2. Oils         3. Cleaning agents      3. Electric hazards         1. Live wires         2. Batteries         3. Electrical systems   8. Workshop accidents, causes and responses      1. Slip, strips and falls      2. Cuts and abrasion      3. Burns      4. Electrical shocks | * Written tests. * Practical * Project * Portfolio of evidence * Third party report |
| 1. Apply material science principles | * 1. Material science principles      1. Definition      2. Importance of material science in engineering   2. Engineering materials Classification and characteristics      1. Metals      2. Polymers      3. Ceramics   3. Properties of engineering materials      1. Mechanical properties         1. Strength         2. Hardness         3. Toughness         4. Malleability         5. Ductility         6. Rigidity      2. Thermal properties         1. Specific heat         2. Thermal expansion      3. Chemical properties         1. Corrosion resistance      4. Electrical properties         1. Electrical conductivity         2. Insulation properties   4. Material selection for engineering materials      1. Factors to consider   5. Material handling safety      1. Handling metals and alloys      2. Chemical and fuels      3. Safety measures for plastics and composites      4. Electrical safety and conductive materials | * Practical * Project * Portfolio of evidence * Third party report * Written tests. |
| 1. Apply Workshop tools and equipment | * 1. Tools and equipment safety and maintenance practices      1. Inspection      2. Safe handling techniques   2. Technical drawing interpretation      1. Purpose of assembly drawing      2. Bill of quantity      3. Assembly instructions   3. Workshop tools and equipment uses and maintenance      1. Measuring tools         1. Tape measure         2. Callipers         3. Micrometer         4. Protractor         5. Spirit level         6. Dial indicator         7. Torque wrench      2. Marking out tools         1. Scriber         2. Marking gauge         3. Combination square      3. Cutting tools         1. Hacksaw         2. Chisel         3. Files         4. Scissors      4. Fitting tools         1. Wrenches         2. Sockets         3. Pliers         4. Hammers         5. Punch         6. Tap and die      5. Forging tools         1. Anvil         2. Hammers         3. Tongs         4. Swage block      6. Sheet metal tools         1. Shears         2. Tin snips         3. Rivet gun         4. Vise      7. Workshop machine         1. Grinding machine         2. Arc welding machine         3. Gas welding machine         4. Drilling machine | * Written tests * Practical * Project * Portfolio of evidence * Third party report |
| 1. Perform material preservation | * 1. Material preservation      1. Definition of material preservation      2. Importances of material preservation      3. Storage techniques   2. Common preservation methods      1. Protective coatings      2. Chemical treatments      3. Physical barriers      4. Controlled storage conditions      5. Proper handling techniques      6. Cleaning and maintenance   3. Material preservation procedure      1. Work requirements assessment      2. Selection of appropriate preservation method | * Practical * Project * Portfolio of evidence * Third party report * Written tests. |
| 1. Perform housekeeping | * 1. Housekeeping      1. Definition      2. Importances of housekeeping   2. Housekeeping activities and their importances      1. Tool and equipment organization      2. Work area cleanliness      3. Safe handling and disposal of hazardous materials      4. Inspection and maintenance of equipment      5. Personal protective equipment management      6. Air and ventilation maintenance      7. Incident prevention and reporting   3. Housekeeping tools and equipment      1. Uses and maintenance         1. Brooms and brushes         2. Dustpans and squeegees         3. Vacuum cleaners         4. Mops and mop buckets         5. Waste bins and recycling containers   4. Housekeeping materials      1. Cleaning cloths and rags      2. Cleaning agents and solvents      3. Lubricants      4. Gloves and PPE’s      5. Disposable bags and liners   5. Workshop waste sorting and disposal      1. Types of waste         1. General waste         2. Hazardous waste         3. Recyclable waste         4. Organic waste         5. e-waste      2. Waste sorting procedure         1. Designated bins for different types of waste         2. Sorting by material         3. Pre-sorting hazardous waste      3. Hazardous waste disposal         1. Chemical waste         2. Used oil and solvents         3. Paints and finishes | * Practical * Project * Portfolio of evidence * Third party report * Written tests. |

**Suggested Delivery Methods**

* Demonstration
* Discussions
* Practical
* Industrials visits
* Simulation

**List of Recommended Resources for 25 trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio (Item: Trainee)** |
| **A** | **Learning Materials** |
|  | Textbooks | Comprehensive textbooks on workshop technology | 25 | 1:1 |
|  | Projector | Functional projector for displaying content during presentations | 1 | 1:25 |
|  | Computer | Functional desktop computer with online instructional content | 1 | 1:25 |
|  | White board | Quality whiteboard of approximately 6 ft by 3 ft for writing during theory instruction | 1 | 1:25 |
|  | Printer | An ink-jet, laser-jet or toner-cartridge printer for printing notes, instructions and working drawings | 1 | 1:25 |
| **B** | **Learning Facilities & Infrastructure** |
|  | Lecture/Theory Room | Spacious room with seats for 25 trainees, approximately 60 sqm | 1 | 1:25 |
|  | Workshop | Standard workshop with bench/fitting area and welding booths approximately 80 sqm | 1 | 1:25 |
| **C** | **Materials and Supplies** |
|  | Dust coat/ overall | Shields skin and regular clothes from sparks | 25 | 1: |
|  | Gloves | Shields hands from sharp edges, heat, and chemical exposure | 25 | 1:1 |
|  | Safety boots | Protects feet from heavy objects, sharp materials, and impact. | 25 | 1:1 |
|  | Welding helmets | Protecting the eyes while providing a clear view of the weld. | 25 | 1:1 |
|  | Ear muffs/ ear plugs | Shields against prolonged exposure to high noise levels from machinery | 25 | 1:1 |
|  | Safety goggles | Protects eyes from flying metal particles, sparks, and dust | 25 | 1:1 |
|  | Raw materials | Steel and aluminum  Plates   * 4mm thickness. * 6 mm thickness.   Pipes   * 4 mm thickness * 6 mm thickness | enough |  |
|  | Arc welding electrodes | Electrodes used in Arc welding | 20 packets |  |
|  | First Aid kit | Fully equipped First Aid kit for use in case of accidents | 1 | 1:25 |
|  | Brooms and cleaning stuff | Hand brooms and mops for cleaning | 10 | 2:5 |
|  | Cotton waste | Absorbent cotton waste for cleaning of oils and other dirt on machines, tools and equipment | Enough |  |
|  | Cleaning detergents | General degreasers | 10 liters |  |
| Floor detergents | 10 liters |
| Hand detergents | 10 liters |
| **D** | **Tools and Equipment** |
| **Measuring tools** | | | | |
|  | Steel rules | Calibrated steel rules for linear measurements | 20 | 4:5 |
|  | Vernier calipers | Calibrated vernier calipers for linear measurements | 20 | 4:5 |
|  | Tri squares | Properly aligned steel Tri-square for checking perpendicular edges | 5 | 1:5 |
|  | Vernier height gauge and surface plates | Calibrated vernier height gauges and surface plates for measurement of heights | 5 | 1:5 |
|  | Measuring tapes | Calibrated measuring tapes for linear measurements | 20 | 4:5 |
|  | Angle gauges | Calibrated steel rules for linear measurements | 5 | 1:5 |
| **Marking out tools** | | | | |
|  | Scribers | steel pencil scribers for marking out lines on metal surfaces | 20 | 4:5 |
|  | Dot punches | Steel dot punches for marking out centres | 20 | 4:5 |
|  | Calipers | Quality steel calipers for marking out arcs on metal surfaces | 5 | 1:5 |
| **Cutting Tools** | | | | |
|  | Assorted hand files | Flat and round hand files for material preparation and finishing | 20 | 4:5 |
|  | Hacksaws | Hack saws with functional frames and blades for cutting metal plates and pipes | 20 | 4:5 |
|  | Tinsnips |  | 10 | 2:5 |
|  | Angle grinders | Portable angle grinders with cutting and grinding disks for cutting and grinding metal plates and pipes | 5 | 1:5 |
| **Work holding tools** | | | | |
|  | Work benches | Stable work benches for carrying out bench work | 5 | 1:5 |
|  | Collet | Hold the tungsten electrode in place | 5 | 1:5 |
|  | Bench vices | Functional bench vices/clamps for holding work pieces during bench work | 20 | 4:5 |
|  | Tongs | Functional pairs of tongs for holding hot pieces of metal during welding | 10 | 2:5 |
| **Finishing tools** | | | | |
|  | Wire brushes | To clean metal surfaces | 20 | 4:5 |
|  | File cards | Cleaning tool used to maintain files | 5 | 1:5 |
| **E** | **Machines and Equipment** |
|  | Arc welding machine | For welding operations | 5 | 1:5 |
|  | Gas welding machine | For welding operations | 5 | 1:5 |
|  | Firefighting equipment | for ensuring safety in workshops where fire hazards are present, such as sparks | 3 |  |
|  | Welding gun | Feeds the filler wire into the weld pool | 5 | 1:5 |
|  | Drilling machine | For drilling operations | 5 | 1:5 |
| **F** | **Reference Materials** |
| 1 | Working drawings |  |  |  |
| 2 | Operation sheets/ templates |  |  |  |
| 3 | Welding Procedure Specifications (WPS) |  | 25 pcs | 1:1 |
| 4 | Training Presentations/Slides | Digital format for shared access among trainees | 1 | 1:25 |
| 6 | Practical Assessment Guides | Worksheets for practical assessments | 25 pcs | 1:1 |

**MECHANICAL SCIENCE**

**UNIT CODE: 0715 441 16A**

**Relationship with Occupational Standards**: Apply Mechanical Science

**Duration of Unit**: **80 Hours**

**Unit Description**

This unit describes the competences required in order to apply mechanical science. It includes resolving forces, determining effects of loads in mechanical systems, analysing properties of materials, determining the nature of friction in mechanical systems and solving problems related to motion.

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **S/No.** | **Learning Outcomes** | **Duration (Hours)** |
|  | Resolve forces | 10 |
|  | Determine effects of loads in mechanical systems. | 20 |
|  | Analyze properties of materials. | 10 |
|  | Determine the nature of friction in mechanical systems | 20 |
|  | Solve problems related to motion. | 20 |
| TOTAL | | 80 |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Resolve forces | * 1. Definition of force   2. Types of force systems      1. Colinear      2. Coplanar      3. Concurrent   3. Theorems of forces      1. Triangle      2. Parallelogram      3. Polygon   4. Resolution of forces      1. Analysis      2. Graphical Method | * Written Tests * Portfolio of Evidence |
| 1. Determine effects of loads in mechanical systems. | * 1. Types of Forces      1. Friction      2. Centrifugal      3. Centripetal      4. Gravitational      5. Inertia   2. Moments      1. Definition      2. Calculations of moment of force about an axis   3. Principles of Moments      1. Clockwise and anticlockwise moments   4. Application of Moments of Forces in Engineering      1. Simply supported beams having point loads   5. Determination of moment couples      1. Simply supported beams with couples | * Written Tests * Portfolio of Evidence |
| 1. Analyze properties of materials | * 1. Mechanical Properties of Materials:      1. Strength (Compressive, Shear. And Tensile)      2. Brittleness      3. Hardness      4. Malleability      5. Plasticity      6. Elasticity      7. Toughness   2. Mechanical Materials Properties Tests      1. Tensile Test      2. Hardness Test   3. Direct Stresses      1. Define Stress      2. Types of Stress:         1. Tensile stress         2. Compressive stress      3. Calculate Stress   4. Selection of Materials      1. Factors to Consider in Materials Selection | * Written Tests * Portfolio of Evidence |
| 1. Determine the nature of friction in mechanical systems | * 1. Friction      1. Definition      2. Advantages and disadvantages of friction   2. Laws of Friction:      1. Laws of static friction      2. Laws of dynamic friction   3. Effects of Friction   4. Applications of Friction      1. Lubrication      2. Tyre Traction      3. Braking Systems      4. Bearing and Bushings      5. Grinding of Tools      6. Transmission Systems | * Written Tests * Portfolio of Evidence |
| 1. Solve problems related to motion. | * 1. Definition of terms      1. Distance      2. Displacement      3. Time      4. Speed      5. Velocity      6. Acceleration   2. Laws of Motion      1. Newton’s First Law of Motion      2. Newton’s Second Law of Motion      3. Newton’s Third Law of Motion   3. Calculating Parameters of Motion      1. Equations of linear and angular motion      2. Calculations         1. Displacement         2. Speed         3. Velocity         4. Acceleration   4. Linear and Angular Motion      1. Converting         1. Angular to Linear Motion         2. Linear to angular motion   5. Motion Graphs      1. Displacement/Time Graphs      2. Velocity/Time Graphs | * Written Tests * Portfolio of Evidence |

**Suggested Delivery Methods**

* Group discussions
* Demonstration by the trainer
* Online video clips
* Power point presentation

**Recommended Resources for 30 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio (Item: Trainee)** |
| **A** | **Learning Materials** | | | |
|  | Textbooks | Comprehensive textbooks on Engineering science | 30 | 1:1 |
|  | Graph books | For graphical representation of solutions | 30 | 1:1 |
|  | Projector | Functional projector for displaying content during presentations | 1 | 1:30 |
|  | Computer | Functional desktop computer with online instructional content | 1 | 1:30 |
|  | White board | Quality whiteboard of approximately 6 ft by 3 ft for writing during theory instruction | 1 | 1:30 |
|  | Printer | An ink-jet, laser-jet or toner-cartridge printer for printing notes, instructions and working drawings | 1 | 1:30 |
| **B** | **Learning Facilities & Infrastructure** | | | |
|  | Lecture/Theory Room | Spacious room with seats for 25 trainees, approximately 60 sqm | 1 | 1:30 |
| **C** | **Materials and Supplies** | | | |
|  | First Aid kit | Fully equipped First Aid kit for use in case of accidents | 1 | 1:30 |
| **D** | **Tools and Equipment** | | | |
|  | Scientific Calculator | For Calculations | 30 | 1:1 |
| **E** | **Reference Materials** | | | |
|  | Training Presentations/Slides | Digital format for shared access among trainees | 1 | 1:30 |
|  | Standard Mathematical Tables | For reference on formulae, identities, laws and principles | 30 | 1:1 |

**ELECTRICAL AND ELECTRONICS PRINCIPLES**

**UNIT CODE:** **0713 441 17A**

**Relationship with Occupational Standards**

This unit addresses the unit of competency: Apply Electrical and electronics principles.

**Unit Duration:** 80 Hours

**Unit Description**

This unit describes the competences required in order to apply electrical and electronics principles. It involves applying basic concepts of electrical quantities, cells and batteries, magnetism and electromagnetism, basic electrical machines and electronics principles.

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **S/No.** | **Learning Outcomes** | **Duration (Hours)** |
|  | Apply basic concepts of electrical quantities | 10 |
|  | Apply DC and AC circuits | 10 |
|  | Apply the concept of cells and batteries | 10 |
|  | Apply magnetism and electromagnetism | 10 |
|  | Apply basic electrical machines | 20 |
|  | Apply electronics components | 20 |
| TOTAL | | 80 |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Use the concept of basic Electrical quantities | * 1. Basic SI Units      1. Overview of SI Units         1. Power (Watts, W)         2. Current (Amperes, A)         3. Resistance (Ohms, Ω)         4. Voltage (Volts, V)   2. Conductors and Insulators      1. Identification and Characteristics         1. Metals vs. non-metals         2. Applications in electrical circuits   3. Electrical Quantities      1. Charge, Force, Work, and Power      2. Definitions and units      3. Calculations involving Electrical quantities   4. Ohm’s Law      1. Understanding Ohm's Law      2. Practical applications and calculations   5. Basic Electrical and Electronic Measurements      1. Measurement Techniques      2. Use of Multimeters, oscilloscopes, and ammeters      3. Measurement accuracy and calibration | * Portfolio of evidence * Practical test * Third party report * Written tests * Project work |
| 1. Apply DC and AC circuits | * 1. Introduction to Electrical Circuits      1. Introduction to electricity:      2. Voltage, current, and power.      3. Overview of DC and AC circuits.      4. Basic circuit elements: Resistors, capacitors, and inductors.   2. DC Circuit Analysis      1. Series and parallel circuits.      2. Voltage and current division principles.      3. Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL).      4. Analysis of complex circuits using KVL and KCL.      5. Hands-on lab: Building and testing DC circuits.   3. AC circuits analysis      1. Introduction to AC: Sinusoidal waveforms, frequency, and period.      2. RMS values, peak values, and average values.      3. AC voltage and current sources.      4. Phasor representation of AC quantities.      5. Impedance and admittance.      6. Series and parallel AC circuits.      7. Resonance in RLC circuits.      8. Practical analysis of AC circuits using phasors.      9. Power in AC Circuits         1. Power factor and power factor correction.         2. Real, reactive, and apparent power.         3. AC power calculations for single-phase and three-phase circuits.         4. Energy consumption and efficiency.         5. Applications of AC power in household and industrial settings.   4. Practical Activity:      1. Connection in series and Parallel Simulation | * Oral questioning * Portfolio of evidence * Practical test * Third party report * Written tests * Project work |
| 1. Apply the concept of cells and batteries | * 1. Introduction to Cells and Batteries   2. Overview of energy storage and electrochemical cells.   3. Basic concepts: Voltage, current, capacity, and energy density.   4. Internal resistance of cells and electromotive force, e.m.f.   5. Electrochemical principles: Redox reactions and electrode potentials.   6. Components of a cell: Anode, cathode, electrolyte, and separator.   7. Types of cells: Primary vs. secondary cells (non-rechargeable vs. rechargeable).   8. Primary Cells (Non-Rechargeable)      1. Zinc-Carbon Cells: Construction, chemistry, and applications.      2. Alkaline Cells: Advantages over zinc-carbon, usage, and performance characteristics.      3. Comparison of common primary cells (e.g., lithium primary cells).      4. Performance limitations and efficiency of primary cells.      5. Environmental impact and disposal considerations for non-rechargeable batteries.      6. Hands-on lab: Testing the performance of different primary cells.   9. Secondary Cells (Rechargeable)      1. Lead-Acid Batteries: Chemistry, construction, and applications (e.g., automotive).      2. Nickel-Cadmium (NiCd) and Nickel-Metal Hydride (NiMH): Differences, pros, and cons.      3. Charging and discharging cycles of rechargeable cells.      4. Lithium-Ion Batteries: Working principles, construction, and applications.      5. Advantages of lithium-ion technology over older battery types.      6. Safety considerations: Overcharging, thermal runaway, and battery management systems.      7. Emerging Technologies: Solid-state batteries, lithium-sulphur, and other advancements.      8. Energy density and power density considerations in modern applications.      9. Batteries maintenance      10. Hands-on lab: Disassembling and examining a rechargeable battery.   10. Battery Performance and Characteristics       1. Battery capacity: Ampere-hour (Ah) ratings and energy content.       2. Factors affecting battery life: Temperature, charge/discharge rates, and cycling.       3. Internal resistance and its effect on performance.       4. Battery efficiency and energy losses.       5. State of charge (SOC) and depth of discharge (DOD).       6. Battery degradation and aging mechanisms.       7. Measuring battery parameters (voltage, current, capacity).       8. Testing techniques for battery health and performance.       9. Hands-on lab: Performance testing of different battery types.   11. Applications of Batteries       1. Batteries in consumer electronics (e.g., smartphones, laptops).       2. Automotive applications: Starting, lighting, and ignition (SLI) batteries.       3. Electric vehicles (EVs) and hybrid electric vehicles (HEVs): Battery requirements and challenges.       4. Industrial and grid storage applications.       5. Renewable energy integration: Solar and wind energy storage solutions.       6. Specialized applications: Medical devices, aerospace, and military.       7. Case studies on battery failure and safety incidents.       8. Discussion on regulations and standards for battery use.   12. Environmental Impact and Recycling       1. Environmental impact of battery production and disposal.       2. Strategies for reducing the ecological footprint of battery technologies.       3. Recycling processes for different types of batteries.       4. Government policies and regulations regarding battery disposal.       5. Advances in battery recycling technologies.   13. Hands-on lab: Exploring the recycling process and evaluating eco-friendly battery alternatives. | * Portfolio of evidence * Practical test * Third party report * Written tests * Project work |
| 1. Apply magnetism and electromagnetism | * 1. Magnetic Circuits and Devices      1. Introduction to magnetic circuits.      2. Magnetic flux, magnetic field density, magnetic field strength, Reluctance, magnetomotive force (MMF), and magnetic flux.      3. Calculations involving magnetic circuits      4. Analogies between electric and magnetic circuits.      5. Magnetic materials in electrical devices (soft and hard magnetic materials).   2. Electromagnetic Induction      1. Faraday’s Law of electromagnetic induction.      2. Lenz's Law: Direction of induced EMF.      3. Practical applications: Electric generators and transformers.      4. Induced EMF in different configurations (moving conductors, changing magnetic fields).      5. Self-induction and mutual induction.      6. Transformers: Working principles, construction, and applications.      7. Step up and step-down transformers      8. Power losses in transformers.      9. Calculations involving transformers      10. Energy stored in magnetic fields. | * Oral questioning * Portfolio of evidence * Practical test * Third party report * Written tests * Project work |
| 1. Apply basic electrical machines | * 1. DC Machines      1. DC machine construction and types (motors and generators).      2. Working principle of DC generators and back EMF.      3. Types of DC generators: Series, shunt, and compound.      4. Working principle of DC motors.      5. Types of DC motors: Series, shunt, and compound.      6. Speed-torque characteristics of DC motors.      7. Performance analysis and efficiency of DC machines.      8. Starting methods for DC motors.      9. Hands-on lab: Testing and operating a DC motor/generator.   2. Induction Motors (AC Machines)      1. Introduction to induction motors: Construction and working principles.      2. Types of induction motors: Squirrel cage and wound rotor.      3. Rotating magnetic fields and slip in induction motors.      4. Equivalent circuit model of an induction motor.      5. Torque-speed characteristics.      6. Methods of starting and speed control.      7. Performance analysis of induction motors.      8. Losses and efficiency considerations.   3. Hands-on lab: Testing and operating an induction motor. | * Portfolio of evidence * Practical test * Third party report * Written tests * Project work |
| 1. Apply electronics components | * 1. Introduction to Electronic Components      1. Overview of electronics: What are electronic components?      2. Classification of components: Passive, active, and electromechanical.      3. Introduction to circuit symbols and schematic diagrams.      4. Basic electrical quantities and units (voltage, current, resistance).      5. Understanding datasheets and component specifications.      6. Overview of testing and measurement tools (multimeters, oscilloscopes).   2. Passive Components      1. Resistors: Types, color codes, power ratings, and applications.      2. Capacitors: Types (ceramic, electrolytic, film), capacitance value, and working voltage.      3. Charging and discharging of capacitors in DC circuits.      4. Applications of capacitors in filtering, timing, and energy storage.      5. Inductors: Types, inductance value, and applications.      6. Inductor behavior in DC and AC circuits.      7. Introduction to filters: RC, RL, and RLC circuits.   3. Semiconductor Devices      1. Diodes: Introduction to PN junctions, characteristics, and types (LEDs, Zener diodes, Schottky diodes).      2. Applications of diodes in rectification, voltage regulation, and signal clipping.      3. Transistors: Types (BJT and MOSFET), characteristics, and configurations.      4. Basic transistor circuits: Switches and amplifiers.      5. Hands-on lab: Building and testing simple diode and transistor circuits.      6. Special semiconductor devices: Thyristors, TRIACs, and optoelectronic devices.      7. Characteristics and applications in switching and control.   4. Integrated Circuits (ICs)      1. Overview of integrated circuits: Analog vs. digital ICs.      2. Operational amplifiers (Op-Amps): Characteristics and basic configurations.      3. Applications of Op-Amps in signal processing.      4. Timers and oscillators: 555 timer IC and its applications.      5. Voltage regulators: Linear and switching regulators.      6. Introduction to data converters (ADC and DAC).      7. Digital ICs: Logic gates and flip-flops.      8. Applications of digital ICs in basic logic circuits.      9. Hands-on lab: Building circuits using Op-Amps, timers, and logic gates.   5. Electromechanical and Specialized Components      1. Relays: Types, operation, and applications in switching.      2. Switches and connectors: Types and usage in electronic circuits.      3. Transformers: Basic operation, step-up/step-down functions, and isolation.      4. Displays: LED, LCD, and seven-segment displays.      5. Circuit Design and Practical Applications      6. Basic circuit design principles: Bread boarding, PCB layout, and soldering.      7. Introduction to circuit simulation tools (e.g., Multisim, LTSpice).      8. Testing and troubleshooting techniques.      9. Real-world applications of electronic components.      10. Building practical projects: Power supplies, audio amplifiers, and sensor-based circuits.      11. Hands-on lab: Final project assembly and testing. | * Portfolio of evidence * Practical test * Third party report * Written tests * Project work |

**Suggested Methods of Instruction**

* Demonstration by trainer
* Practice by the trainee
* Field trips
* Discussions

**Recommended Resources for 25 trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio (Item: Trainee)** |
| **A** | **Learning Materials** |  |  |  |
| 1 | Textbooks | Comprehensive texts on electrical and control principle. | 5 pcs | 1:5 |
| 2 | Charts | Visual aids covering electrical theories and safety protocols | 10 pcs | 1:2.5 |
| 3 | PowerPoint Presentations | For trainer’s use, covering course content and practical applications | 1 | 1:25 |
| **B** | **Learning Facilities & Infrastructure** |  |  |  |
| 1 | Lecture/Theory Room | Equipped with projectors and seating for 25 trainees, ~60 sqm | 1 | 1:25 |
| 2 | Workshop | Hands-on training area with workbenches, tools, and safety equipment, ~80 sqm | 1 | 1:25 |
| 3 | Computer Laboratory | Equipped with testing setups for electrical experiments, ~50 sqm.  Equipped with computers installed with Circuit simulation software. | 25 | 1:1 |
|  |  |  |  |  |
| **C** | **Consumable Materials** |  |  |  |
| 1 | Electrical Wires | Assorted sizes and color-coded (e.g., 1.5mm², 2.5mm², 4mm²) | 5 rolls | 1:5 |
| 2 | Insulation Tapes | For securing connections and insulation, assorted colors | 25 pcs | 1:1 |
| 3 | Breadboard | For prototyping and testing circuits | 5 pcs | 1:5 |
| 4 | Sensors | Assorted types (temperature, pressure, proximity) | 10 pcs | 1:2.5 |
| 5 | Signal generators | For generating AC signals | 5pcs | 1:5 |
| 6 | Transducers | Assorted | 10 pcs | 1:3 |
| 7 | Electronic components | Resistors, transistors, capacitors, relays, transformers. Integrated IC, OPAM. | 100pcs | 4:25 |
|  |  |  |  |  |
| **D** | **Tools and Equipment** |  |  |  |
| 1 | Screwdrivers | Assorted sets for various applications | 2 sets | 1:12.5 |
| 2 | Side Cutters | For cutting wires and cables | 4 pcs | 1:6.25 |
| 3 | Pliers | For gripping and bending wires | 3 pcs | 1:8.33 |
| 4 | Stripping Knives | For stripping insulation from wires | 4 pcs | 1:6.25 |
| 5 | Computers | Equipped with electrical and electronics simulation software | 5 pcs | 1:5 |
| 6 | Multimeters | For measuring voltage, current, and resistance | 5 pcs | 1:5 |
| 7 | Clamp Meters | For measuring current flow in circuits | 5 pcs | 1:5 |
| 8 | Oscilloscope | For observing waveforms and signals | 1 | 1:25 |
| 9 | Voltmeter | For measuring voltage | 1 | 1:25 |
| 10 | Ammeter | For measuring current | 1 | 1:25 |
| 11 | Signal Generator | For generating electrical signals for testing | 1 | 1:25 |
| 12 | Soldering gun | For soldering | 10 | 1:3 |
| 13 | Soldering wire | For making joints in electrical circuits | 10 | 1:3 |
| 14 | PLC | For program practice | 5 | 1:5 |
| 15 | Cells and batteries | For learning | 5 | 1:5 |
|  |  |  |  |  |
| **E** | **PPE (Personal Protective Equipment)** |  |  |  |
| 1 | PPE Sets | Includes helmets, gloves, safety goggles, shoes, and harnesses | 25 sets | 1:1 |
| 2 | Safety Signs and Barriers | For simulating safety zones and hazards | 10 sets | 1:2.5 |
| 3 | Earthing Test Kits | For ground testing and demonstrating earthing procedures | 5 pcs | 1:5 |
| 4 | Electrical Test Benches | For hands-on testing of functionality and circuit design | 5 pcs | 1:5 |
|  |  |  |  |  |
| **F** | **Reference Materials** |  |  |  |
| 1 | Industrial Automation Manuals | Covering principles and practices in automation | 25 pcs | 1:1 |
| 2 | Electrical Standards | Reference on industry standards (e.g., IEEE Guidelines) | 5 pcs | 1:5 |
| 3 | Technical Handbooks | On motors, drives, and wiring systems | 25 pcs | 1:1 |
| 4 | Training Presentations/Slides | Digital format for shared access among trainees | 1 | 1:25 |
| 5 | Multimedia Learning Modules | Digital licenses for videos and tutorials | 25 pcs | 1:1 |
| 6 | Practical Assessment Guides | Worksheets for practical assessments | 25 pcs | 1:1 |

**CORE UNITS OF LEARNING**

**GLASS COMPONENTS MAINTAINANCE**

**ISCED UNIT CODE:** 0716 451 18A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Maintain Glass Components

**Duration of unit:** 140 Hours

**Unit Description:**

This unit of learning covers the learning outcomes, content, assessment methods, methods of delivery and resources required to train rigging activities to maintain glass components. It involves competencies in inspect vehicle glass components, repair vehicle glass and performing housekeeping.

**Summary of Learning Outcomes**

By the end of this unit of learning, the trainee will be able to:

|  |  |  |
| --- | --- | --- |
| **S/No.** | **Learning Outcome** | **Duration (Hours)** |
|  | Inspect Vehicle Glass Components | 60 |
|  | Repair vehicle Glass | 60 |
|  | Perform House Keeping | 20 |
| **Total** | | 140 |

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Inspect Vehicle Glass Components | * 1. Workplace preparation.  1. Debris removal. 2. Tools and materials arrangement    1. Tools and safety barriers set up. 3. Barriers and signage set up 4. Tools and safety equipment verification.    1. Glass inspection tools selection 5. Use tools such as magnifiers and lights for detailed inspection. 6. Prepare cleaning agents and polishing compounds for glass maintenance.    1. Glass edges inspection. 7. Chips 8. Cracks 9. Uneven edges.    1. Surface clarity assessment. 10. Glass examination     * + 1. Smudges         2. Scratches         3. Distortions affecting visibility     1. Glass mounting area inspection. 11. Verify the alignment of mounting surfaces 12. Check for debris and seal integrity | * Practical * Project * Written assessment * Oral assessment |
| 1. Repair vehicle glass | 1. Glass surface cleaning 2. Dust debris removal 3. Drying and preparation. 4. Repair resin/filler application. 5. Resin injection 6. Resin coverage and curing 7. Bubbles removal and surface polishing 8. Resin curing 9. UV light 10. curing agents     * 1. Filler application     1. Surface polishing | * Practical * Project * Written assessment * Oral assessment |
| 1. Perform House Keeping | * 1. Waste Disposal and Management.      1. Recycling and segregating materials   2. Disposing hazardous waste   3. Tools and Equipment      1. Cleaning tools   4. Storing tools and equipment   5. Cleaning the workshop | * Practical * Project * Written assessment * Oral assessment |

**Suggested Methods of Instruction**

* Practical
* Project Work
* Demonstrations
* Direct instruction with active learning strategies
* Group Discussions
* Demonstration

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | Recommended Ratio  (Item: Trainee) |
| **A** | **Learning materials and infrastructure** | | | |
|  | Training Classes: 1 session | 8M\*20M | 1 | 1:25 |
|  | Workshops: 1 practical workshop | 18M\*12M | 1 | 1:25 |
|  | Computer |  | 1 | 1:25 |
|  | Projector for presentations |  | 1 | 1:25 |
|  | Whiteboard for collaborative learning | 4 ft by 8 ft | 1 | 1:25 |
|  | Access to Internet |  | 1 | 1:25 |
|  | Textbooks | Textbooks on glass maintenance | 5 pcs | 1:5 |
|  |  |  |  |  |
| **B** | **Tools and Equipment** | | | |
|  | **Inspection Tools Set** | | | |
|  | Magnifiers | Various magnification levels | 5 | 1:5 |
|  | LED Inspection Lights | High-intensity | 5 | 1:5 |
|  | Crack Detection Tools |  | 5 | 1:5 |
|  | **Glass Repair Equipment** | | | |
| 1. | UV Curing Lamps | Professional grade | 5 | 1:5 |
| 2. | Resin Injection Tools | With pressure gauges | 5 | 1:5 |
| 3. | Polishing Equipment | Various grades | 5 | 1:5 |
|  | **Surface Preparation Tools** | | | |
|  | Glass Scrapers | Professional grade | 5 | 1:5 |
|  | Buffing Machines | Variable speed | 3 | 1:8 |
|  | **Measuring and Assessment Tools** | | | |
|  | Digital Thickness Gauges |  | 2 | 1:13 |
|  | Light Meters | For tint verification | 2 | 1:13 |
|  | Tool Storage Systems | Organized cabinets | 3 | 1:8 |
| **C** | **Materials** | | | |
|  | **Glass Repair Materials** | | | |
| 1. | Repair Resins | Various viscosities | 10 | 1:3 |
| 2. | UV Curing Agents | Professional grade | 10 | 1:3 |
| 3. | Glass Fillers | Various types | 10 | 1:3 |
| 4. | Cleaning Materials |  |  |  |
| 5. | Glass Cleaners | Professional grade | 5 | 1:5 |
| 6. | Microfiber Cloths | Lint-free | 25 | 1:1 |
| 7. | Surface Preparation Solutions |  | 5 | 1:5 |
|  | **Polishing Materials** | | | |
| 1. | Polishing Compounds | Various grades | 5 | 1:5 |
|  | Polishing Pads | Various types | 10 | 1:3 |
|  | Safety Equipment |  |  |  |
|  | Safety Glasses | UV protected | 25 | 1:1 |
|  | Work Gloves | Cut-resistant | 25 | 1:1 |
|  | Dust Masks |  | 25 | 1:1 |
|  | Safety Barriers | Portable | 5 | 1:5 |
|  | Warning Signs | Various types | 5 | 1:5 |
|  | **Practice Materials** | | | |
| 1. | Practice Glass Panels | With various defects | 10 | 1:3 |
| 2. | Training Glass Samples | Different types | 10 | 1:3 |
| 3. | Waste Management |  |  |  |
| 4. | Glass Disposal Containers | Cut-proof | 2 | 1:13 |
| 5. | Chemical Waste Containers | For resins and solutions | 2 | 1:13 |
| 6. | General Waste Bins |  | 3 | 1:8 |

**MODULE V**

**COMMON UNITS OF LEARNING**

**COMPUTER AIDED DRAWING**

**UNIT CODE:** 0732 541 19A

**UNIT DURATION: 140 Hours**

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Perform computer aided drawing.

**Unit description**

This unit covers the competences required to perform computer aided drawing. It involves navigating CAD software, producing geometric, pictorial, orthographic and assembly drawings as well as designing mechanical components.

**Summary of Learning Outcomes**

By the end of the Unit of Learning, the trainee will be able to;

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| **1.** | Navigate CAD software | 10 |
| **2.** | Produce geometric drawings | 30 |
| **3.** | Produce pictorial drawings | 10 |
| **4.** | Produce orthographic drawings. | 30 |
| **5.** | Produce assembly drawings | 30 |
| **6.** | Design mechanical components | 30 |
| Total | | 140 |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Navigate CAD software | * 1. Overview of CAD      1. Definition and significance of CAD in engineering and design.      2. Historical development of CAD technologies.   2. Computing Equipment and Software      1. Identify hardware requirements for CAD operations.      2. List popular CAD software options (e.g., AutoCAD, SolidWorks, Inventor).   3. Drawing CAD Software      1. Overview of the software interface.      2. Functions and capabilities of CAD tools.   4. CAD Software Templates      1. Explore various templates available for different drawing requirements.   5. Importing CAD Files      1. Process of importing files (DWG, STL, DXF, STEP) into the working space.   6. User Interface Navigation      1. Familiarization with the CAD software interface.      2. Understanding toolbars, menus, and command lines.   7. Setting Up the Drawing Environment      1. Units and measurement settings.      2. Creating a new drawing and saving files.   8. Symbols, Codes, and Standards      1. Identify relevant symbols and codes according to software functionality.   9. Understand and utilize drawing Elements      1. Points      2. Line angles      3. Circles and arcs      4. Planes (horizontal, vertical)      5. Figures and solids      6. Shapes      7. Objects snapping settings      8. Polar tracking settings.      9. Orthomode utilization   10. Use editing commands Editing Tools       1. Delete, undo and redo commands       2. Fillet and chamfer commands       3. Trim, extend and break commands       4. Zoom and pan commands       5. Move, copy, and paste commands       6. Rotate and mirror commands       7. Object snapping and grouping commands       8. Dimension and scaling commands | * Written tests * Practical * Portfolio of evidence * Third party report |
| 1. Produce geometric drawings | * 1. Setting Drawing Lines      1. Recognize standard drawing line conventions * Dimension lines * Hidden detail lines * Extension lines * Section lines * Break lines * Chain   1. Using drawing lines   2. Constructing Types of Angles      1. Use trigonometry principles to construct acute, obtuse, and right angles.   3. Constructing Geometrical Forms      1. Create circles, rectangles, triangles, and polygons according to standards.   4. Developing Geometric Drawings      1. 2-Dimensional      2. Orthographic      3. Isometric | * Written tests * Practical * Portfolio of evidence * Third party report |
| 1. Produce pictorial drawings | * 1. Drawing Symbols and Abbreviations      1. Apply standard drawing symbols and abbreviations in pictorial drawings.   2. Producing Pictorial Drawings      1. Techniques for creating isometric, oblique, cabinet, and cavalier drawings.   3. Saving Pictorial Drawings      1. Procedures for saving drawings in appropriate formats. | * Written tests * Practical * Portfolio of evidence * Third party report |
| 1. Produce orthographic drawings. | * 1. Fundamentals of Orthographic Projection      1. Definition and importance of orthographic drawing.      2. Differences between orthographic and other drawing types (isometric, perspective).   2. Types of Orthographic Projections      1. First-angle projection.      2. Third-angle projection.   3. Understanding Views      1. Front, top, and side views.      2. Additional views (sectional, auxiliary).   4. First Angle Orthographic Drawings      1. Develop first-angle drawings adhering to standard conventions.   5. Third Angle Orthographic Drawings      1. Create third-angle drawings based on standard practices.   6. Saving Orthographic Drawings      1. Techniques for properly saving orthographic drawings.   7. Dimensioning Orthographic Views   8. Printing orthographic views   9. Creating isometric drawing      1. Choosing isometric cursor      2. Dimensioning isometric drawing      3. Printing isometric drawing   10. Creating 3D model       1. Choosing 3D workspace       2. 3D workspace modifying tool (3D orbit, 3D mirrors, union, extrude, press pull, e.t.c)       3. Rendering       4. Pring 3D models | * Written tests * Practical * Portfolio of evidence * Third party report |
| 1. Produce assembly drawings | * 1. Overview of Assembly Drawings      1. Definition and purpose of assembly drawings.      2. Importance in manufacturing and engineering.   2. Types of Assembly Drawings      1. General assembly drawings vs. detailed assembly drawings.      2. Exploded view vs. isometric assembly drawings.   3. Exploding Orthographic Views      1. Techniques for exploding views in accordance with standard conventions.   4. Exploding Pictorial Views      1. Create exploded pictorial views based on drawing specifications.   5. Assembling Views      1. Assemble orthographic and pictorial views accurately.   6. Producing Sectional Views      1. Generate sectional views according to drawing standards.   7. Developing Parts List      1. Creating a parts list based on the drawing schematic. | * Written tests * Practical * Portfolio of evidence * Third party report |
| 1. Design mechanical components | * 1. Designing Mechanical Components      1. Apply CAD principles to design mechanical components per work requirements.   2. Applying CAE in Simulation      1. Use computer-aided engineering tools for simulating mechanical designs.   3. Determining Improvements      1. Analyze design results to identify efficiency improvements.   4. Creating a Manufacturing Database      1. Develop a database to support the manufacturing process.   5. Improving Design Documents      1. Make enhancements to design documents based on manufacturing feedback.   6. Practical Activity | * Written tests * Practical * Portfolio of evidence * Third party report |

**Suggested Delivery Methods**

* Demonstration
* Group discussions
* Exercises
* Online materials
* Direct instructions
* Simulation

**Recommended resources for 30 trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio (Item**  **)** |
| **A** | **Learning Materials** |  |  |  |
| 1 | Textbooks | Comprehensive texts on CAD basics, history, and hardware requirements. | 5 pcs | 1:5 |
| 2 | Charts | Visual aids covering CAD software evolution and industry applications. | 10 pcs | 1:2.5 |
| 3 | PowerPoint Presentations | For trainer’s use, covering CAD definitions, history, and hardware requirements. | 1 | 1:25 |
| **B** | **Learning Facilities & Infrastructure** |  |  |  |
| 1 | Lecture/Theory Room | Equipped with projector, seating for 25 trainees, ~60 sqm. | 1 | 1:25 |
| 2 | Computer Laboratory | Equipped with 25 computers installed with CAD software, ~80 sqm. | 25 | 1:1 |
| 3 | Printer/plotter | For printing CAD drawings | 2 | 1:13 |
| 4 | 3D printer | For printing 3D models | 2 | 1:13 |
| 5 | 3D printer filament | 3D printing material | 2 rolls | 1:13 |
| **C** | **Consumable Materials** |  |  |  |
| 1 | USB Drives | For storing and transferring CAD project files. | 25 pcs | 1:1 |
| 2 | Notebooks | For trainees to take notes during CAD sessions. | 25 pcs | 1:1 |
| **D** | **Tools and Equipment** |  |  |  |
| 1 | Computers | Equipped with CAD software and compatible hardware (e.g., high RAM, graphics support). | 25 pcs | 1:1 |
| 2 | Projector | For displaying CAD software demonstrations and presentations in lecture room. | 1 | 1:25 |
| 3 | External Hard Drives | For backing up CAD files and course materials. | 5 pcs | 1:5 |
| 4 | Drawing Tablets | For CAD software use, supporting stylus input for design precision. | 5 pcs | 1:5 |
| **E** | **Reference Materials** |  |  |  |
| 1 | CAD Software Manuals | Documentation detailing CAD software functionalities and hardware requirements. | 25 pcs | 1:1 |
| 2 | CAD Industry Case Studies | Case studies showcasing CAD applications in engineering and design. | 5 pcs | 1:5 |
| 3 | Practical Assessment Guides | Worksheets for practical assessments on CAD navigation and hardware requirements. | 25 pcs | 1:1 |
| 4 | Training Presentations/Slides | Digital format for shared access among trainees covering CAD course content. | 1 | 1:25 |

**ENGINEERING MATHEMATICS**

**Unit Code:** 0541 541 20A

**Unit Duration:** 100 Hours

**Relationship to Occupational Standards**

**This unit addresses the Unit of Competency:** Apply Engineering Mathematics

**Unit Description**

This unit describes the competences required in order to apply engineering mathematics. It enables the learner to; Apply complex numbers, perform coordinate geometry, carry out binomial expansion, apply calculus, apply vector theorem and Apply matrices

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **S/No.** | **Learning Outcomes** | **Duration (Hours)** |
|  | Apply complex numbers | 10 |
|  | Perform coordinate geometry | 10 |
|  | Carry out binomial expansion | 20 |
|  | Apply calculus | 40 |
|  | Apply vector theorem | 10 |
|  | Apply matrices | 10 |
|  | | 100 |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Apply complex numbers | * 1. Complex geometry      1. Real part      2. Imaginary part      3. Argand diagram      4. Modulus/Magnitude      5. Argument /Angle      6. Conjugate   2. Operations      1. Addition      2. Subtraction      3. Multiplication      4. Division      5. Conversions         1. Polar form to rectangular form         2. Rectangular form to polar form   3. De Moivre’s theorem      1. Expansion of complex numbers      2. Roots of complex numbers      3. Trigonometric identities using complex numbers | * Written tests |
| 1. Perform coordinate geometry | * 1. Cartesian geometry      1. Cartesian plane         1. x and y axes         2. Positive and negative coordinates      2. Gradient         1. Positive         2. Negative         3. Zero         4. Infinite         5. Gradients of parallel line         6. Gradients of perpendicular lines      3. y-intercept   2. Linear equations      1. Straight line      2. Parallel lines      3. Perpendicular lines   3. Graphs of linear equations      1. Straight lines   4. Polar geometry      1. Magnitude      2. Direction      3. Graphs   5. Conversions      1. Linear to polar      2. Polar to linear   6. Solving polar equations | * Written tests |
| 1. Carry out binomial expansion | * 1. Binomial series      1. Powers      2. Coefficients      3. Pascals triangle      4. Expansion   2. Binomial theorem      1. Positive powers of n      2. Negative powers of n      3. Fractional powers of n (roots)      4. Estimation of errors of small changes | * Written tests |
| 1. Apply calculus | * 1. Differentiation up to third order      1. Functions         1. Linear         2. Trigonometric         3. Logarithmic         4. Exponential      2. Rules         1. Power         2. Product         3. Chain         4. Quotient      3. Applications         1. Stationary points         2. Rates of change   2. Integration      1. Standard integral      2. Definite integral      3. Techniques         1. By parts         2. Substitution         3. Partial fractions      4. Applications         1. Area between and under curves         2. Volume      5. DIifferential equation      6. Double and triple integral      7. Laplace transform      8. Fourior series | * Written tests |
| 1. Apply vector theorem | * 1. Differentiate between vector and scalar quantities      1. Magnitude      2. Direction         1. Positive         2. Negative   2. Operation on vectors      1. Addition      2. Subtraction      3. Dot product      4. Cross product   3. Resolution of vectors      1. Analysis      2. Graphical Methods         1. Triangle theorem         2. Parallel theorem         3. Polygon theorem | * Written tests |
| 1. Apply matrices | * 1. Matrices      1. Types         1. Row         2. Column         3. Square         4. Zero         5. Identity         6. Diagonal   2. Matrices operations (up to 3 x 3)      1. Addition      2. Subtraction      3. Multiplication   3. Inverse of matrices (up to 3 x 3)      1. Determinant      2. Transpose      3. Adjoint      4. Inverse   4. Simultaneous equations   (up to 3 equations)   * + 1. Inverse method     2. Crammers Rule     3. Row reduction | * Written tests |

**Suggested Delivery Methods**

* Demonstration
* Group discussions
* Online materials
* Direct instructions
* Simulation

**Recommended Resources for 30 trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio (Item: Trainee)** |
| **A** | **Learning Materials** | | | |
|  | Textbooks | Comprehensive textbooks on Engineering Mathematics | 30 | 1:1 |
|  | Graph books | For graphical representation of solutions | 30 | 1:1 |
|  | Projector | Functional projector for displaying content during presentations | 1 | 1:30 |
|  | Computer | Functional desktop computer with online instructional content | 1 | 1:30 |
|  | White board | Quality whiteboard of approximately 6 ft by 3 ft for writing during theory instruction | 1 | 1:30 |
|  | Printer | An ink-jet, laser-jet or toner-cartridge printer for printing notes, instructions and working drawings | 1 | 1:30 |
| **B** | **Learning Facilities & Infrastructure** | | | |
|  | Lecture/Theory Room | Spacious room with seats for 25 trainees, approximately 60 sqm | 1 | 1:30 |
| **C** | **Materials and Supplies** | | | |
|  | First Aid kit | Fully equipped First Aid kit for use in case of accidents | 1 | 1:30 |
|  | Brooms and cleaning stuff | Hand brooms and mops for cleaning | 10 | 2:5 |
| **D** | **Tools and Equipment** | | | |
|  | Set of Mathematical instruments | For constructions and measurements | 30 | 1:1 |
|  | Firefighting extinguishers | Water, carbon dioxide and chemical powder fire extinguishers for fire fighting | 1 | 1:30 |
| **F** | **Reference Materials** | | | |
|  | Training Presentations/Slides | Digital format for shared access among trainees | 1 | 1:30 |
|  | Standard Mathematical Tables | For reference on formulae, identities, laws and principles | 30 | 1:1 |

**ENGINEERING MECHANICS**

**UNIT CODE: 0715 541 16A**

**Relationship to Occupational Standards**: Apply Engineering Mechanics

**Duration of Unit**: 80 Hours

**Unit Description**

This unit of competency describes the competences required in order to apply engineering mechanics principles. This includes, applying simple mechanisms, designing belts, ropes and chain drives, designing toothed gears and gear trains, designing mechanical rotor dynamic machines, applying stress and strain concepts, determining loading conditions, applying simple bending theory and applying torsion theory in mechanical systems.

**Summary of Learning Outcomes**

By the end of this unit, trainees should be able to;

|  |  |  |
| --- | --- | --- |
| S/No | Learning Outcome | Duration ( Hours) |
|  | Simple Mechanisms | 10 |
|  | Belts, Ropes and Chain Drives | 10 |
|  | Toothed Gears and Gear Trains | 10 |
|  | Mechanical Rotor Dynamic Machines | 10 |
|  | Stress And Strain Concepts in Mechanical Systems | 10 |
|  | Loading Conditions in Mechanical Systems | 10 |
|  | Simple Bending Theory in Mechanical Systems | 10 |
|  | Torsion Theory in Mechanical Systems | 10 |
| Total | | 80 |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. simple mechanisms | * 1. Define simple mechanism   2. Components of simple mechanism      1. Link      2. Element   3. Types of mechanisms      1. Single slider mechanism      2. Double slider mechanism | * Written Tests |
| 1. belts, ropes and chain drives | * 1. Definition      1. Belt      2. Rope      3. Chain   2. Belts      1. Material used for belt         + 1. Rubber           2. Cotton           3. Leather      2. Types of belts   2.2.2.1 Flat  2.2.2.2 V belt  2.2.2.3 Circular   * + 1. Configuration of belt drive   2.2.3.1Open   * + - 1. Crossed     1. Design Analysis of Flat and V-Belts   2.2.4.1Velocity ratio   * + - 1. Length of belt       2. Angle of contact       3. Power transmitted   1. Rope Drives      1. Types of rope drives   2. Chain Drives      1. Types of chain drives | * Written Tests |
| 1. toothed gears and gear trains | * 1. Types of Gears      1. Spur      2. Helical      3. Double helical   2. Types of Gear Trains      1. Simple gear train         1. Design calculations      2. Compound gear train         1. Design calculations      3. Reverted gear train         1. Design calculations      4. Epicyclic gear train      5. Lubrication of gears | * Written Tests |
| 1. Design mechanical rotor dynamic machines | * 1. Types of pumps and operation principle      1. Reciprocating pump      2. Centrifugal pump   2. Derivation of equations for      1. Reciprocating pumps      2. Centrifugal pumps   3. Analysis of pumps      1. Discharge      2. Efficiency      3. Power      4. Head      5. Weight per unit   4. Types and operation principle of rotary compressors      1. Rotary screw compressors      2. Rotary vane compressors      3. Scroll compressor      4. Rotary lobe   5. Analysis of compressors      1. Inlet and outlet flow      2. Work done      3. Mass flow rate      4. Power requirement      5. Efficiency   6. Compressor Fans and Vanes      1. Structure and functions of compressor fans and vanes      2. Operation principles of fans and vanes in rotary compressors      3. Maintenance of fans and vanes   7. Design Analysis      1. Vane efficiency      2. Fan efficiency      3. Power consumption | * Written Tests |
| 1. Apply stress and strain concepts in mechanical systems | * 1. Define stress and strain   2. Types of simple stresses      1. Direct      2. Shear      3. Ultimate tensile stress      4. Yield stress      5. Breaking stress      6. True stress   3. Analysing stress on      1. Beams      2. Thin cylinders      3. Thin shells   4. Applications of stress and strain concepts      1. Bolts and nuts      2. Shafts | * Written Tests |
| 1. Determine loading conditions in mechanical systems | * 1. Define structure   2. Types of loading      1. Point load      2. Uniformly distributed load      3. Varying load   3. Types of beams      1. Simply supported beams      2. Cantilever beam   4. Overhanging beam |  |
| 1. Apply simple bending theory in mechanical systems | * 1. Engineers Bending Equation   2. Types of Beams      1. Simply supported beams      2. Cantilever beam      3. Overhanging beam   3. Analysis of Beams      1. T-section      2. L-section      3. I-section   4. Types of Shafts      1. Solid      2. Tubular      3. stepped   5. Analysis of shafts      1. Solid      2. Tubular      3. Stepped | * Written Tests |
| 1. Apply torsion theory in mechanical systems | * 1. Define Torsion   2. Torque Analysis   3. Analysis of Shafts      1. Series arranged shafts      2. Parallel arranged shafts   4. Determine angle of twist      1. Engineers’ torsion equation | * Written tests |

**Suggested Delivery Methods**

* Group discussions
* Demonstration by the trainer
* Online video clips
* Power point presentation
* Exercises by trainee

**Recommended resources for 25 trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio (Item: Trainee)** |
| **A** | **Learning Materials** | | | |
|  | Textbooks | Comprehensive textbooks on Engineering Mathematics | 30 | 1:1 |
|  | Graph books | For graphical representation of solutions | 30 | 1:1 |
|  | Projector | Functional projector for displaying content during presentations | 1 | 1:30 |
|  | Computer | Functional desktop computer with online instructional content | 1 | 1:30 |
|  | White board | Quality whiteboard of approximately 6 ft by 3 ft for writing during theory instruction | 1 | 1:30 |
|  | Printer | An ink-jet, laser-jet or toner-cartridge printer for printing notes, instructions and working drawings | 1 | 1:30 |
| **B** | **Learning Facilities & Infrastructure** | | | |
|  | Lecture/Theory Room | Spacious room with seats for 25 trainees, approximately 60 sqm | 1 | 1:30 |
| **C** | **Materials and Supplies** | | | |
|  | First Aid kit | Fully equipped First Aid kit for use in case of accidents | 1 | 1:30 |
|  | Brooms and cleaning stuff | Hand brooms and mops for cleaning | 10 | 2:5 |
| **D** | **Tools and Equipment** | | | |
|  | Calculators | For calculations | 30 | 1:1 |
|  | Firefighting extinguishers | Water, carbon dioxide and chemical powder fire extinguishers for fire fighting | 1 | 1:30 |
| **F** | **Reference Materials** | | | |
|  | Training Presentations/Slides | Digital format for shared access among trainees | 1 | 1:30 |

**VEHICLE STRUCTURE WELDING II**

**ISCED UNIT CODE:** 0716 551 22A

**Relationship to occupational standards**

This unit addresses the unit of competency: Weld Vehicle Structure.

**Duration of unit:** 150 Hours

**Unit Description:**

This unit specifies competencies required by an Autobody technician to weld vehicle body parts. It involves arc welding vehicle cross members, MIG Welding vehicle structure, TIG Welding vehicle structure and Spot-welding vehicle structure

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| **1.** | Arc weld vehicle cross members | 30 |
| **2.** | MIG Weld vehicle structure | 30 |
| **3.** | TIG Weld vehicle structure | 30 |
| **4.** | Spot weld vehicle structure | 30 |
| **5.** | Gas weld vehicle structure | 30 |
| Total | | 150 |

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Arc weld vehicle cross members | * 1. Workplace safety      1. OSHA      2. local safety standards      3. first aid measures      4. burns      5. eye injuries   2. PPEs in Arc welding      1. Welding helmet/ hand shield/ welding goggles      2. Respirator      3. Fire resistant clothing and apron      4. Earmuffs/ ear plugs      5. A pair of rubber soled safety boots      6. Insulated gloves   3. Vehicle body structure leveling      1. Misalignment      2. Structural weakness      3. spirit levels      4. laser levels      5. digital inclinometers   4. Arc Welding tools materials and equipment      1. Steel sheet metal      2. Aluminum      3. stainless steel      4. grinders      5. clamps      6. cutting tools      7. files      8. measuring devices      9. marking tools      10. marking table      11. Arc welding machine   5. Joint preparation      1. Butt joint      2. Lap joint      3. Edge joint      4. Tee joint      5. Fillet joint      6. Cleaning      7. Beveling      8. Aligning workpieces      9. Filing   6. Arc Welding machine Setup      1. power source      2. cables      3. electrode holder      4. ground clamp      5. electrode   7. Arc welding machine settings      1. adjusting voltage      2. amperage   8. Arc welding machine safety      1. Grounding      2. Safe handling      3. Inspection   9. Arc welding process      1. Manal Metal Arc welding principle      2. Striking the arc      3. bead formation      4. Welding position   10. Arc welding Specifications       1. Porosity       2. slag inclusions       3. undercutting   11. Post**-**weld treatment       1. Slag removal       2. Stress relief       3. Corrosion protection   12. Weld treatment       1. Cleaning welds       2. Grinding       3. wire brushing       4. slag removal       5. Heat treatments   13. Weld quality examination       1. ISO 17637 standards for visual examination of welds       2. Checking for cracks       3. Weld dimensions       4. smooth appearance       5. proper fusion       6. no excessive spatter       7. Inspection checklist and examination documentation | * Practical * Written tests * Project * Third party report |
| 1. MIG Weld vehicle structure | * 1. Workplace safety      1. OSHA      2. local safety standards      3. first aid measures   2. PPEs in MIG welding      1. Welding helmet/ hand shield/ welding goggles      2. Respirator      3. Fire resistant clothing and apron      4. Earmuffs/ ear plugs      5. A pair of rubber soled safety boots      6. Insulated gloves   3. Vehicle body structure leveling      1. Misalignment      2. Structural weakness      3. spirit levels      4. laser levels      5. digital inclinometers   4. MIG welding tools materials and equipment      1. MIG welding machine      2. MIG welding accessories   5. MIG Welding machine Setup      1. continuous wire feed mechanism      2. shielding gas      3. solid wire      4. flux-cored wire      5. argon      6. CO₂      7. electrode holder      8. electrode   6. MIG welding machine settings      1. Calibrating voltage      2. wire feed speed      3. amperage   7. MIG welding machine safety      1. Grounding      2. gas flow      3. wire feed consistency      4. Inspection   8. MIG welding process      1. MIG welding principle      2. Arc initiation      3. Welding position   9. MIG welding Specifications      1. Porosity      2. slag inclusions      3. undercutting      4. bead consistency   10. Weld quality examination       1. ISO 17637 standards for visual examination of welds       2. Checking for cracks       3. Weld dimensions       4. Inspection checklist and examination documentation | * Practical * Written tests * Project * Third party report |
| 1. TIG Weld vehicle structure | * 1. Workplace safety      1. OSHA      2. local safety standards      3. electric shock      4. UV radiation      5. harmful fumes   2. PPEs in TIG welding      1. Welding helmet/ hand shield/ welding goggles      2. Respirator      3. Fire resistant clothing and apron      4. Earmuffs/ ear plugs      5. A pair of rubber soled safety boots      6. Insulated gloves   3. Vehicle body structure leveling      1. Misalignment      2. Structural weakness   4. TIG welding tools materials and equipment      1. TIG welding machine      2. TIG welding accessories      3. Steel sheet metal      4. Aluminum      5. stainless steel      6. grinders      7. clamps      8. cutting tools      9. files      10. measuring devices      11. marking tools      12. marking table   5. TIG Welding machine Setup      1. Power source      2. welding torch      3. filler rod      4. shielding gas shielding gas      5. tungsten electrode         1. 2% Thoriated for steel         2. Pure Tungsten for aluminum   6. TIG welding machine settings      1. Calibrating voltage      2. amperage   7. TIG welding machine safety      1. Grounding      2. Gas leaks      3. Inspection   8. TIG welding process      1. TIG welding principle      2. Filler material adding techniques   9. TIG welding Specifications      1. tungsten inclusions      2. porosity      3. undercuts      4. improper fusion   10. Weld quality examination       1. ISO 17637 standards for visual examination of welds       2. Checking for cracks       3. Weld dimension       4. Inspection checklist and examination documentation | * Practical * Written tests * Project * Third party report |
| 1. Spot weld vehicle structure | * 1. Workplace safety      1. OSHA      2. local safety standards      3. electrical shock      4. burns   2. PPEs in Spot welding      1. Welding helmet/ hand shield/ welding goggles      2. Respirator      3. Fire resistant clothing and apron      4. Earmuffs/ ear plugs      5. A pair of rubber soled safety boots      6. Insulated gloves   3. Vehicle body structure leveling      1. Misalignment      2. Structural weakness   4. Spot welding tools materials and equipment      1. Spot welding machine      2. Spot welding accessories.      3. Steel sheet metal      4. Aluminum      5. stainless steel      6. grinders      7. clamps      8. cutting tools   5. Spot Welding machine Setup      1. Power source      2. Electrodes      3. Controller      4. Cooling system   6. Spot welding machine settings      1. Voltage      2. Amperage      3. Time      4. electrode pressure   7. Surface Preparation for Spot Welding      1. Cleaning      2. degreasing the metal surfaces      3. rust and dirt removal      4. grinders      5. sanders      6. cleaning brushes   8. Spot welding process      1. electrode positioning      2. pressure application      3. current control      4. weld spacing      5. number of welds      6. weld strength   9. Typesof Post-Weld Treatments      1. Cleaning the weld area      2. wire brushes      3. chemical cleaners      4. Heat treatment      5. Paint      6. Galvanization   10. Weld quality examination       1. Checking for common weld defects       2. Cracks       3. insufficient fusion       4. weak joints   11. Inspection checklist and examination documentation | * Practical * Written tests * Project * Third party report |
| 1. Gas weld vehicle structure | * 1. Workplace safety      1. OSHA      2. local safety standards   2. PPEs in Arc welding      1. Welding helmet/ hand shield/ welding goggles      2. Respirator      3. Fire resistant clothing and apron      4. Earmuffs/ ear plugs      5. A pair of rubber soled safety boots      6. Insulated gloves   3. Vehicle body structure leveling      1. Misalignment      2. Structural weakness      3. Use of spirit levels and laser levels   4. Gas Welding tools materials and equipment      1. Steel sheet metal      2. Aluminum      3. Gas cylinders      4. Brazing rods      5. Gas regulators      6. Welding torches      7. Gas welding accessories files      8. measuring devices   5. Gas welding machine set setup      1. Welding torch      2. Hoses      3. gas regulators      4. oxygen and acetylene cylinders   6. Gas welding machine safety      1. Inspecting the hoses and regulators for leaks      2. Damage      3. Wear      4. Free from flammable materials   7. Gas welding machine settings      1. purging the system of air      2. setting the flame      3. neutral flame      4. carburizing flame      5. oxidizing flame   8. Gas welding process      1. Gas Welding Techniques      2. flame control      3. torch handling      4. weld pool management      5. techniques for adding filler material to the weld joint      6. weld size      7. position      8. type      9. Heat control      10. workpiece      11. Gas welding defects      12. Penetration      13. Porosity      14. Excessive spatter   9. Post**-**weld treatment      1. stress relief      2. heat treatment      3. surface finishing      4. Weld treatment      5. Cleaning the weld area to remove oxidation,      6. slag, and impurities removal      7. wire brushes      8. chemical cleaners      9. painting      10. rust inhibitors   10. Weld quality inspection       1. ISO 17637 standards for visual examination of welds       2. Weld size       3. Uniformity       4. Penetration       5. absence of defects   11. Inspection checklist and examination documentation | * Practical * Written tests * Project * Third party report |

**Suggested Methods of Instruction**

* Practical
* Project Work
* Demonstrations
* Direct instruction
* Group Discussions
* Demonstration

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio (Item: Trainee)** |
| **A** | **Learning Materials** | | | |
|  | Textbooks | Comprehensive textbooks on Motorcycle Mechanics | 25 | 1:1 |
|  | Projector | Functional projector for displaying content during presentations | 1 | 1:25 |
|  | Computer | Functional desktop computer with online instructional content | 1 | 1:25 |
|  | White board | Quality whiteboard of approximately 6 ft by 3 ft for writing during theory instruction | 1 | 1:25 |
|  | Printer | An ink-jet, laser-jet or toner-cartridge printer for printing notes, instructions and working drawings | 1 | 1:25 |
| **B** | **Learning Facilities & Infrastructure** | | | |
|  | Lecture/Theory Room | Spacious room with seats for 25 trainees, approximately 60 sqm | 1 | 1:25 |
|  | Workshop | Standard workshop with bench/fitting area and welding booths approximately 180 sqm | 1 | 1:25 |
| **C** | **Materials and Supplies** | | | |
|  | Dust coat/ overall | Shields skin and regular clothes from sparks | 25 | 1:25 |
|  | Welding Gloves | Shields hands from sharp edges, heat, and chemical exposure | 25 | 1:1 |
|  | Safety boots | Protects feet from heavy objects, sharp materials, and impact. | 25 | 1:1 |
|  | Ear muffs/ ear plugs | Shields against prolonged exposure to high noise levels from machinery | 25 | 1:1 |
|  | Welding shield and goggles | Protects eyes from flying metal particles, sparks, and dust | 25 | 1:1 |
|  | Vehicle fabrication materials | (angle sections, square sections, rectangular tubes, channel bars, flat bars, circular tubes, round bars - sufficient quantities) | 5 | 1:5 |
|  | Filler rods |  | 5 | 1:5 |
|  | Gas Regulators |  | 5 | 1:5 |
|  | Oxygen and acetylene cylinders |  | 5 | 1:5 |
|  | Inert Gas cylinder |  | 5 | 1:5 |
|  | Arc Welding electrode |  | 5 | 1:5 |
|  | Brazing and gas welding rods |  | 5 | 1:5 |
|  | Bolts, Nuts and Screws | For mechanical joining | 5 | 1:5 |
| **D** | **Tools and Equipment** | | | |
| **Measuring tools** | | | | |
|  | Tape measures |  | 5 | 1:5 |
|  | Vernier calipers, |  | 5 | 1:5 |
|  | Spirit levels |  | 5 | 1:5 |
|  | Steel rule |  | 5 | 1:5 |
| **Fastening tools** | | | | |
|  | Full Spanner Sets | For fastening bolts and nuts | 5 | 1:5 |
|  | 6-piece Screwdriver Sets | For fastening screws | 5 | 1:5 |
|  | Torque Wrenches | For fastening bolts and nuts at specific torque | 5 | 1:5 |
| **Striking Tools** | | | | |
|  | Hammers | For striking | 10 | 1:3 |
|  | Soft hammers | For striking soft parts without damaging | 10 | 1:3 |
|  | Chipping Hammer | For removing slug | 10 | 1:3 |
| **Cutting tools** | | | | |
|  | Chisel | For cutting | 5 | 1:5 |
|  | Combination Pliers | For various functions including cutting and holding. | 5 | 1:5 |
|  | Tinsnips | For cutting sheet metals | 5 | 1:5 |
|  | Hacksaw | For cutting metal parts | 5 | 1:5 |
|  | Files | For Edge Preparation | 5 | 1:5 |
|  | **Marking tools** | | | |
|  | Scriber | For marking out | 5 | 1:5 |
|  | Angle plate | For marking out | 5 | 1:5 |
|  | Chalk | For marking out | 5 | 1:5 |
| **E** | **Machines and Equipment** | | | |
|  | Gas cutting equipment | For cutting metals | 1 | 1:25 |
|  | Metal bending machines | (hydraulic, pneumatic, mechanical) | 1 | 1:25 |
|  | MIG welding machine | For welding metals together | 2 | 1:12.5 |
|  | TIG welding machine | For welding metals together | 2 | 1:12.5 |
|  | ARC welding machine | For welding metals together | 2 | 1:12.5 |
|  | SPOT welding machine | For welding metals together | 2 | 1:12.5 |
|  | GAS welding machine | For welding metals together | 2 | 1:12.5 |
|  | Jigs | (template, plate, diameter, channel, ring) | 5 | 1:5 |
|  | Clamps | For holding metals while welding | 5 | 1:5 |
| **F Special Tools** | | | | |
|  | Cleaning brush |  | 5 | 1:5 |
|  | Grinders |  | 5 | 1:5 |
| **G** | **Reference Materials** | | | |
| 1 | Operation sheets/ templates |  |  |  |
| 2 | Manufacturers service manuals |  | 25 pcs | 1:1 |
| 3 | Training Presentations/Slides | Digital format for shared access among trainees | 1 | 1:25 |
| 4 | Practical Assessment Guides | Worksheets for practical assessments | 25 pcs | 1:1 |

**MODULE VI**

**VEHICLE BODY DESIGN**

**ISCED UNIT CODE:** 0716 551 23A

**Relationship to occupational standards**

This unit addresses the unit of competency: Design Vehicle Body

**Duration of unit:** 140 Hours

**Unit Description:**

This unit describes the competencies required by an auto body technician to design a vehicle body. It involves preparing vehicle structural drawing, simulating vehicle design and preparing bill of materials.

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| **1.** | Prepare vehicle structural drawing | 60 |
| **2.** | Simulate vehicle design | 60 |
| **3.** | Prepare vehicle body bill of materials | 20 |
| Total | | 140 |

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Prepare vehicle structural drawing | * 1. Introduction to KS-372 Standards   2. Vehicle body structure design sketching      1. Basics of Vehicle Structure Design         1. Chassis         2. Frame         3. body panels      2. Types of vehicle structures         1. Body-on-frame structure         2. Unitary body structure         3. Space structure         4. Backbone structure         5. Triangulated tube structure         6. Monocoque structure         7. Punt structure      3. Hand Sketching Techniques for Vehicle Structure Design         1. Front view         2. Side view         3. top view      4. Using sketching tools         1. Pencils         2. Rulers         3. Templates         4. vehicle designs   Annotating sketches   * + - 1. Dimensions       2. material specifications       3. Structural features   1. Interpreting Vehicle Structure Designs      1. Design requirements based on customer specifications and regulatory guidelines      2. Design features, components, and functional elements      3. Developing Working Drawings from Vehicle Structure Designs      4. Converting hand sketches into detailed working drawings      5. Dimensions      6. Materials      7. Sectional views and exploded diagrams      8. KS-372 Standards in Working Drawings   2. Vehicle Design Specifications      1. KS 372      2. KS ISO 898,      3. KS 376      4. KS 649      5. KS 664      6. KS 822   3. Vehicle body designs drawing using CAD software      1. Criteria for evaluating different design options;         1. Feasibility         2. Safety         3. Cost         4. compliance with KS-372      2. Introduction to CAD Software for Vehicle Design         1. AutoCAD         2. SolidWorks      3. Basic functions of CAD software         1. Drawing tools         2. Layers         3. Dimensioning         4. Modifying features      4. Using CAD tools draw the sketched designs in line with KS standards      5. Documenting Design Changes in CAD   4. Creating 2D Diagrams in CAD Software      1. Front      2. Side      3. Top views      4. Sectional views      5. Using CAD 2D software features         1. Grid alignment         2. Dimensioning tools         3. Layers         4. Scales         5. units in CAD software      6. Applying KS-372 Standards in 2D Diagrams | * Practical * Written tests * Project * Third party report |
| 1. Simulate vehicle design | * 1. Introduction to 3D Modeling in CAD      1. 3D modeling concepts and their applications in vehicle design      2. Differences between 2D and 3D representations      3. Benefits of 3D modeling   2. Converting 2D Drawings to 3D Models   3. Importing 2D CAD drawings into 3D modeling software   4. Tools and techniques;      1. Extruding      2. Revolving      3. Lofting 2D profiles to create 3D geometry   5. Aligning 2D front, side, and top views to build accurate 3D vehicle models   6. Adding details to the 3D model      1. Fillets      2. Chamfers      3. Holes   7. Vehicle design models rendering using computer   8. Clay modelling of scaled and full-size vehicle body designs   9. Approval and presentation of vehicle body models   10. Job specification sheet preparation from the working drawing | * Practical * Written tests * Project * Third party report |
| 1. Prepare vehicle body bill of materials | * 1. Vehicle part assemblies      1. Service doors      2. Emergency doors      3. Floor deck      4. Gangway      5. Cant rails      6. Roof      7. Window planes and windscreen      8. Handrails and handholds      9. Ventilators      10. Passenger seats      11. Seatbelt anchorage      12. Interior lights      13. Passenger entry steps      14. Door locks, window locks and boot locks      15. Electrical wiring      16. Luggage carriers   2. Part assembly list structure and documentation   3. Vehicle components costing as per the structural drawing   4. Bill of Materials for Vehicle Structural Body      1. Welding rods      2. Electrode wires      3. Cutting disc      4. Grinding disc      5. Work pieces | * Practical * Written tests * Project * Third party report |

**Suggested Methods of Instruction**

* Practical
* Project Work
* Demonstrations
* Direct instruction
* Group Discussions

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio (Item: Trainee)** |
| **A** | **Learning Materials** | | | |
|  | Textbooks | Comprehensive textbooks on Motorcycle Mechanics | 25 | 1:1 |
|  | Projector | Functional projector for displaying content during presentations | 1 | 1:25 |
|  | Computer | Functional desktop computer with online instructional content | 1 | 1:25 |
|  | White board | Quality whiteboard of approximately 6 ft by 3 ft for writing during theory instruction | 1 | 1:25 |
|  | Printer | An ink-jet, laser-jet or toner-cartridge printer for printing notes, instructions and working drawings | 1 | 1:25 |
| **B** | **Learning Facilities & Infrastructure** | | | |
|  | Lecture/Theory Room | Spacious room with seats for 25 trainees, approximately 60 sqm | 1 | 1:25 |
|  | Workshop | Standard workshop with bench/fitting area and welding booths approximately 180 sqm | 1 | 1:25 |
| **C** | **Materials and Supplies** | | | |
|  | Dust coat/ overall | Shields skin and regular clothes from sparks | 25 | 1:25 |
|  | Welding Gloves | Shields hands from sharp edges, heat, and chemical exposure | 25 | 1:1 |
|  | Safety boots | Protects feet from heavy objects, sharp materials, and impact. | 25 | 1:1 |
|  | Ear muffs/ ear plugs | Shields against prolonged exposure to high noise levels from machinery | 25 | 1:1 |
|  | Welding shield and goggles | Protects eyes from flying metal particles, sparks, and dust | 25 | 1:1 |
|  | Writing Materials (notebooks, pens, pencils) | For sketching vehicle body desisgns | 5 | 1:5 |
|  | Clay for Modeling | (for hands-on design practice) | 50 kg | - |
|  | Cutting and Grinding Discs | For cutting | 25 | 1:1 |
| **D** | **Tools and Equipment** | | | |
| **Measuring tools** | | | | |
|  | Tape measures |  | 5 | 1:5 |
|  | Vernier calipers, |  | 5 | 1:5 |
|  | Spirit levels |  | 5 | 1:5 |
|  | Steel rule |  | 5 | 1:5 |
| **Fastening tools** | | | | |
|  | Full Spanner Sets | For fastening bolts and nuts | 5 | 1:5 |
|  | 6-piece Screwdriver Sets | For fastening screws | 5 | 1:5 |
|  | Torque Wrenches | For fastening bolts and nuts at specific torque | 5 | 1:5 |
| **Striking Tools** | | | | |
|  | Hammers | For striking | 10 | 1:3 |
|  | Soft hammers | For striking soft parts without damaging | 10 | 1:3 |
|  | Chipping Hammer | For removing slug | 10 | 1:3 |
| **Cutting tools** | | | | |
|  | Chisel | For cutting | 5 | 1:5 |
|  | Combination Pliers | For various functions including cutting and holding. | 5 | 1:5 |
|  | Tinsnips | For cutting sheet metals | 5 | 1:5 |
|  | Hacksaw | For cutting metal parts | 5 | 1:5 |
|  | Files | For Edge Preparation | 5 | 1:5 |
|  | **Marking tools** | | | |
|  | Scriber | For marking out | 5 | 1:5 |
|  | Angle plate | For marking out | 5 | 1:5 |
|  | Chalk | For marking out | 5 | 1:5 |
| **E** | **Machines and Equipment** | | | |
|  | Computers | With CAD software installed, including AutoCAD and SolidWorks | 25 | 1:1 |
|  | Licenses for 3D Modeling Tools | (software for CAD programs) | 5 | 1:5 |
|  | Welding Equipment Sets | (Including welding rods and electrode wires) | 5 | 1:5 |
| **G** | **Reference Materials** | | | |
| 1 | Industry Standard Reference Books | (covering KS-372 and related standards) | 25 pcs | 1:1 |
| 2 | Vehicle Body Design Specification Sheets | (templates for students) | 25 pcs | 1:1 |
| 3 | Operation sheets/ templates |  | 25 pcs | 1:1 |
| 4 | Manufacturers service manuals | For manufacturers specifications | 25 pcs | 1:1 |
| 5 | Training Presentations/Slides | Digital format for shared access among trainees | 1 | 1:25 |
| 6 | Practical Assessment Guides | Worksheets for practical assessments | 25 pcs | 1:1 |

**VEHICLE BODY TRIMING**

**ISCED UNIT CODE:** 0716 551 24A

**Relationship to occupational standards**

This unit addresses the unit of competency: Trim vehicle body.

**Duration of unit:** 150 Hours

**Unit Description:**

This unit covers the competencies required by an Autobody technician to trim vehicle body. It involves observing occupational health and safety, collecting trim materials, upholstering vehicle interior, padding vehicle cushion seat, installing vehicle restraints, install airbag, replacing mouldings, emblems and pin-striping, documenting and updating protocol book.

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| **1.** | Upholster vehicle interior | 30 |
| **2.** | Pad vehicle cushions | 30 |
| **3.** | Install vehicle restraints | 30 |
| **4.** | Fit vehicle body accessories | 30 |
| **5.** | Perform vehicle buffing services | 30 |
| Total | | 150 |

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| Upholster vehicle interior | * 1. Workplace safety      1. OSHA      2. Workplace safety protocols   2. Personal Protective Equipment      1. Goggles      2. masks      3. Workplace safety standards Goggles      4. Ear muffs      5. Safety mask      6. Head gear      7. A pair of safety boots      8. Cotton-leather gloves      9. Overall   3. Identifying Upholstery Materials      1. Types of upholstery materials:         1. Leather         2. Vinyl         3. Fabric         4. Synthetic leather      2. Material properties:         1. Durability         2. Flexibility         3. Color         4. Texture   4. Upholstery Materials      1. Trim fabrics      2. Faux leather      3. Headlining material      4. Cushion foam, felt and fibre board      5. Adhesive conta glue      6. Measuring and cutting materials to fit specific vehicle parts:         1. Seats         2. Door panels         3. Dashboards      7. Using templates and patterns to ensure precision      8. Preparing materials for stitching:         1. Marking         2. Notching         3. Reinforcing      9. Pre-treatment of materials:         1. Cleaning         2. Softening         3. Stretching   5. Sewing Upholstery Materials      1. Types of stitching techniques:         1. Double stitching         2. Piping, French seams      2. Tools for sewing:         1. Industrial sewing machines,         2. Needles         3. Threads      3. Sewing reinforcement for areas prone to stress: Corners, edges, seams      4. Inspecting seams for durability and appearance   6. Adhesive application on Surface to Be Trimmed      1. Spray adhesives      2. Contact cement      3. Hot glue      4. Application techniques:         1. Even spreading         2. brush-on         3. spray-on methods      5. Ensuring proper adhesion without bubbles or gaps      6. Drying and curing times for different adhesives   7. Fitting Cured Upholstery Material on Vehicle Body      1. Aligning and positioning material for a snug fit on seats, panels, and other parts      2. Techniques for stretching and securing material:         1. Clamps         2. Staples         3. Clips      3. Trimming excess material for a clean, professional finish | * Practical * Written tests * Project * Third party report |
| Pad vehicle cushions | * 1. Upholstery Materials      1. Leather      2. Fabric      3. Vinyl      4. Suede      5. Synthetic leather      6. Considerations;         1. Color         2. Texture      7. Manufacturer guidelines   2. Upholstery Tools and Equipment      1. Sewing machines      2. Staple guns      3. Scissors      4. Cutters      5. Foam cutters      6. Hog ring pliers      7. Tack hammers      8. Heat guns      9. Power tools      10. Hand tools      11. Trim removal tool kit      12. Hand scissors      13. Straight, curved needles and skewers      14. Industrial Sewing machine      15. Mold removal wedges      16. Adhesive remover      17. Pin-striping brushes      18. Adhesive application tools: Spray guns, brushes, rollers   3. Upholstery Materials preparation      1. Measuring, cutting, and shaping materials to fit seats, panels, headliners      2. Using patterns, templates, or digital designs for precision      3. Pre-treating materials: Cleaning, softening, or stretching      4. Reinforcing materials for high-wear areas      5. Organizing materials by section for efficient assembly   4. Sewing Upholstery Materials      1. Double stitching      2. Decorative stitching      3. Piping      4. Industrial sewing machines      5. Handheld sewing machines      6. Reinforcement of seams and edges for durability      7. Inspecting stitch quality: Alignment, tension, and neatness   5. Adhesive application on Surface to Be Trimmed      1. Contact cement      2. spray adhesives      3. heat-activated adhesives      4. Techniques for even adhesive application: Brushing, spraying, rolling      5. Ensuring proper bonding: No air bubbles, smooth application   6. Upholstery Material fitting      1. Stretching and aligning material      2. Securing material using staples, clips, or adhesive bonding      3. Removal of wrinkles, bubbles, and loose spots      4. Final trimming and finishing for a clean look | * Practical * Written tests * Project * Third party report |
| Install vehicle restraints | * 1. Identifying Vehicle Restraints      1. Seat belts      2. Harnesses      3. airbags      4. Restraint specifications:         1. Load ratings         2. Materials         3. Design      5. Checking for manufacturer part numbers and compatibility with the vehicle model   2. Mounting Vehicle Restraints on Seat Frame      1. KS-372 standards for vehicle restraint systems      2. Mounting procedure for seat belts and restraints      3. Tools and equipment required for installation:         1. Wrenches         2. Torque tools         3. Drills      4. Ensuring proper alignment and secure fastening of restraints      5. Inspecting mounted restraints for stability and safety compliance   3. Integrating Vehicle Restraints with Electrical System      1. Airbag systems, tensioners      2. Manufacturers wiring diagrams      3. Integrating restraints with existing vehicle electronics      4. Final inspection and verification of restraint system | * Practical * Written tests * Project * Third party report |
| Fit vehicle body accessories | * 1. Vehicle Body Accessories      1. Spoilers      2. Side mirrors      3. Trims      4. Mudguards Bike rack      5. Tow bars      6. Wind screen washer      7. Roof Racks and Roof Rails      8. Accessories alignment with vehicle model and design   2. Vehicle surface preparation      1. Cleaning      2. Degreasing the surface before accessory installation      3. Sanding or scuffing the surface to enhance adhesion      4. Applying primer or adhesive promoter for glued accessories      5. Masking areas not to be affected during preparation      6. Ensuring the surface is dry, dust-free   3. Vehicle Body Accessories Fitting      1. Tools and equipment required for fitting:         1. Drills         2. Wrenches         3. Adhesive applicators      2. Techniques for securing accessories:         1. Bolting         2. Clipping         3. Bonding      3. Manufacturer’s instructions      4. Testing accessory functionality; Lights, sensors, electronic components | * Observation * Practical * Written tests * Project * Third party report |
| Perform vehicle buffing services | * 1. Buffing Materials and Equipment      1. Cutting compounds      2. Polishing compounds      3. Swirl removers      4. Buffing pads; Wool pads, foam pads, microfiber pads      5. Buffing machines: Rotary buffers, dual-action polishers      6. Buffing machine setting      7. Safety practices during buffing   2. Vehicle Body for Buffing preparation      1. Cleaning dirt, grease, and contaminants      2. Inspection;         1. Scratches         2. Swirls         3. Oxidation      3. Masking areas; Trim, rubber seals, sensitive areas      4. Applying lubricant or water (for wet buffing) as required   3. Vehicle Body Buffing      1. Buffing compound on the vehicle surface      2. Buffing techniques:         1. Consistent pressure         2. Overlapping motions      3. Adjusting machine speed and pad selection based on the surface condition      4. Removing excess compound after buffing with microfiber towels      5. Inspecting the surface for uniform shine and absence of swirls or haze      6. Final polishing to enhance gloss and smoothness | * Practical * Written tests * Project * Third party report |

**Suggested Methods of Instruction**

* Practical
* Project Work
* Demonstrations
* Direct instruction
* Group Discussions

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio (Item: Trainee)** |
| **A. Learning Materials** | | | | |
| 1 | Textbooks | Comprehensive textbooks on workplace safety and autobody upholstery techniques | 25 | 1:1 |
| 2 | Projector | Functional projector for presentations and visual aids | 1 | 1:25 |
| 3 | Computer | Desktop computer with instructional materials and access to digital content | 1 | 1:25 |
| 4 | Whiteboard | Quality whiteboard for instruction, approximately 6 ft x 3 ft | 1 | 1:25 |
| 5 | Printer | Printer for handouts, patterns, and instructions | 1 | 1:25 |
| **B. Learning Facilities & Infrastructure** | | | | |
|  | Lecture/Theory Room | Spacious room with desks and chairs for 25 trainees (minimum 60 sqm) | 1 | 1:25 |
|  | Workshop | Equipped workshop for practical work, approximately 180 sqm | 1 | 1:25 |
| **C. Materials and Supplies** | | | | |
|  | PPE | Full PPE sets, including gloves, headgear, googles and mask | 25 | 1:1 |
|  | Upholstery materials | Leather, vinyl, fabric, synthetic leather | 25 | 1:1 |
|  | Adhesives (contact glue) | Spray adhesives, hot glue, and contact cement | 25 | 1:1 |
|  | Cushion materials | Cushion foam, felt, and fiberboard | 25 | 1:1 |
|  | Cleaning supplies | Detergents, degreasers, cotton waste | 25 | 1:1 |
|  | Safety equipment | Fire extinguishers, first aid kit | 1 | 1:25 |
| **D. Tools and Equipment** | | | | |
| **Measuring Tools** | | | | |
|  | Measuring tapes | Standard measuring tools | 10 | 1:3 |
|  | Templates | Patterns for precise cuts |  |  |
| **Fastening Tools** | | | | |
|  | Staple guns | For securing upholstery materials | 5 | 1:5 |
|  | Hog ring pliers | For fastening upholstery materials | 5 | 1:5 |
| **Cutting tools** | | | | |
|  | Scissors | Heavy-duty scissors for trimming | 10 | 1:3 |
|  | Foam cutters | For shaping cushion materials | 5 | 1:5 |
| **Special tools** | | | | |
|  | Industrial sewing machines | For stitching heavy upholstery materials | 5 | 1:5 |
|  | Heat guns | For stretching and shaping vinyl | 5 | 1:5 |
| **Machines and Equipment** | | | | |
|  | Buffing machines | Dual-action and rotary buffers | 5 | 1:5 |
|  | Upholstery sewing equipment | Industrial-grade sewing machines | 5 | 1:5 |
| **Reference Materials** | | | | |
|  | Manufacturers’ manuals | Comprehensive guides for upholstery tasks | 25 | 1:1 |
|  | Operation sheets | Task-specific operation guidelines | 25 | 1:1 |
|  | Digital content | Presentations and slides for lectures | 1 | 1:25 |

**MODULE VII**

**COMMON UNITS OF LEARNING**

# APPLY THERMODYNAMICS AND FLUID MECHANICS

**UNIT CODE:** 0715 541 25A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply thermodynamics and fluid mechanics

**Duration of Unit**: 140 hours

**Unit Description**

This unit describes the competences required in order to apply thermodynamics and fluid mechanics in their work. it includes applying thermodynamic processes, applying knowledge of perfect gases, applying knowledge of steam cycle, applying knowledge of fuel combustion, applying heat transfer and heat exchangers in fluid, operating air compressors, applying knowledge of flow of fluids, applying knowledge of viscous flow of fluids, applying dimensional and models analysis fluids and operating fluid pumps

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
|  | To Apply Thermodynamic Processes | 14 |
|  | To Apply knowledge of perfect gases | 14 |
|  | To Apply knowledge of steam cycle | 14 |
|  | To Apply knowledge of fuel combustion | 14 |
|  | To Apply heat transfer and heat exchangers in fluid | 14 |
|  | To Operate air compressors | 14 |
|  | To Apply the knowledge of the flow of fluids | 14 |
|  | To Apply the knowledge of viscous flow of fluids | 14 |
|  | To Apply dimensional and models analysis fluids | 14 |
|  | To Operate fluid pumps | 14 |
| TOTAL | | 140 |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Apply Thermodynamic Processes | * 1. Basic thermodynamics terms definition      1. work,      2. Power      3. Internal Energy      4. Heat      5. Temperature   2. Laws of Thermodynamics      1. First law of thermodynamics      2. Second law of thermodynamics      3. Zeroth law of thermodynamics   3. Thermodynamic Processes      1. Non-flow Process.      2. Constant Volume Process      3. Constant Pressure Process      4. Hyperbolic Process.      5. Constant Temperature Process      6. Adiabatic Process      7. Polytropic Process.   4. Thermodynamics systems      1. Boundary and surrounding      2. Closed systems      3. Open systems      4. Isolated systems      5. Adiabatic system      6. Homogeneous systems      7. Heterogeneous systems   5. Heating and expansions of gases      1. Determine work done      2. Application of First Law of Thermodynamics      3. Reversible non-flow processes.      4. Irreversible non-flow processes   6. General Laws for Expansion and Compression      1. Define the terms:         1. Expansion         2. compression      2. Apply PVn = Constant for various values of n      3. Curves of pressure against volume for various values of n (index)   7. Application of Steady Flow Energy Equation to:      1. boilers      2. condensers      3. nozzles      4. diffusers      5. compressors      6. turbines | * Written tests |
| 1. Apply knowledge of perfect gases | * 1. Laws of Perfect Gases      1. Boyle's Law      2. Charles' Law      3. Gay-Lussac Law      4. Joule's Law      5. Avogadro's Law   2. General Gas Equation      1. Derive and apply general gas equation PV=nRT   3. Characteristic Equation of Gas      1. Application in engineering calculations   4. Universal Gas Constant      1. Define universal gas constant      2. Apply universal gas constant equation in engineering calculation   5. Specific Heat      1. Constant Volume      2. Constant Pressure | * Written tests |
| 1. Apply knowledge of steam cycle | * 1. Steam cycles      1. Rankine         1. Schematic diagram of a steam engine or turbine plant.         2. Determine Rankine efficiency         3. T-S and h-s graphs         4. Modified Rankine Cycle         5. Work-done using Rankine equations         6. Efficiency of Modified Rankine Cycle         7. Theoretical loss of work per kg of steam due to incomplete expansion         8. Loss in Rankine efficiency due to restricted expansion of steam         9. Enthalpy- entropy chart      2. Carnot         1. Draw schematic diagrams of Carnot engine         2. Carnot Cycle with Steam as Working Substance         3. Performance Criteria for Carnot Cycle      3. Reheat         1. T-S diagram of reheat steam cycle         2. Determine work-done using reheat equations         3. Determine efficiency of reheat cycles      4. Regenerative         1. Ideal regenerative cycle diagram         2. Regenerative Cycle with Single Feed Water Heater         3. Regenerative cycle with single feed water heater diagram         4. Determine work-done by Regenerative cycle         5. Determine Regenerative cycle efficiency         6. Regenerative Cycle with Two Feed Water Heaters and its efficiency   2. Thermodynamics steam turbines      1. Characteristics of steam turbines      2. classification of Steam Turbines      3. Pressure and Velocity of Steam in an Impulse Turbine      4. Velocity Triangles for Moving Blade of an Impulse Turbine      5. Combined Velocity Triangle for Moving Blades      6. Power Produced by an Impulse Turbine | * Written tests |
| 1. Apply knowledge of fuel combustion | * 1. Elements and Compounds of fuel      1. Define of terms         1. Element         2. Compound         3. Atoms         4. Molecules         5. Atomic Mass         6. Molecular Mass      2. Element and symbols table sketches   2. Combustion Equations of Fuels and calculations      1. Balanced Combustion Equations of Solid Fuels      2. Write a balanced Combustion Equations of Gaseous Fuels   3. Conversion analysis of fuels      1. Theoretical or Minimum Volume of Air Required for Complete Combustion      2. Conversion of Volumetric Analysis into Mass Analysis or Gravimetric Analysis      3. Conversion of Mass Analysis into Volumetric Analysis   4. Mass of Carbon in Flue Gases      1. Calculation of mass of carbon, contained in 1 kg of flue or exhaust gases   5. Mass of Flue Gases per kg of Fuel Burnt      1. Calculate the mass of dry flue gases by comparing the mass of carbon present in the flue gases with the mass of carbon in the fuel.   6. Excess Air Supplied calculations      1. Mass of excess air supplied by the mass of unused oxygen, found in the flue gases.      2. Total mass of air supplied   7. Flue Gas Analysis by Ors at Apparatus      1. Components      2. Use of the apparatus      3. Operation      4. Diagram sketches | * Written tests |
| 1. Apply heat transfer and heat exchangers in fluid | * 1. Heat transfer media      1. Heat Transfer methods:         1. Conduction         2. Convection         3. Radiation      2. Newton's Law of Cooling      3. Derivation and application of Fourier's\* Law of Heat Conduction equation   2. Heat Transfer by Conduction   through   * + 1. Slab        1. Thermal Conductivity        2. Temperature Gradient     2. Composite Wall     3. Thick Cylinder     4. Thick Sphere   1. Overall Coefficient of Heat Transfer      1. Heat exchangers | * Written tests |
| 1. Operate air compressors | * 1. Classification of air compressors      1. According to working      2. According to action      3. According to number of stages   2. Single Stage Reciprocating Air Compressor      1. Work done by a Single Stage Reciprocating Air Compressor without Clearance Volume   3. Work done during      1. isothermal compression      2. polytropic compression (pv" = Constant)      3. isentropic compression   4. Power Required to Drive a Single-stage Reciprocating Air Compressor      1. Calculations   5. Work-done by Reciprocating Air Compressor with Clearance Volume      1. Calculations      2. Determine Multistage Compression   6. Power Required to Drive a Two-stage Reciprocating Air Compressor   7. Minimum Work Required for a Two-stage Reciprocating Air Compressor | * Written tests |
| 1. Apply knowledge of flow of fluids | * 1. Types of Fluid Flow      1. Steady and unsteady flows      2. Uniform and non-uniform flows      3. Rotational and irrotational flows      4. Laminar and turbulent flows      5. Compressible and incompressible flows   2. Loss of Energy (or Head) in Pipes      1. Darcy-weisbach formula      2. Chezy’s formula for loss of head due to friction      3. Loss of head due to sudden enlargement      4. Loss of head due to sudden contraction      5. Loss of head due to obstruction in pipe      6. Loss of head at the entrance to pipe      7. Loss of head at the exit of a pipe      8. Loss of head due to bend in the pipe   3. Hydraulic Gradient and Total Energy Lines      1. Pipes in Series or Compound Pipes      2. Pipes in Parallel      3. Power Transmission through Pipes | * Written tests |
| 1. Apply knowledge of viscous flow of fluids | * 1. Flow of viscous flow      1. Flow of Viscous Fluid in Circular Pipes      2. Flow of Viscous Fluid through an Annulus      3. Flow of Viscous Fluid Between Two Parallel Plates         1. One plate moving and other at rest         2. Both plates at rest         3. Both plates moving in opposite directions      4. Kinetic energy correction and momentum      5. Power Absorbed in Viscous Flow      6. Viscous Resistance of Journal Bearings      7. Viscous Resistance of Foot-step      8. Viscous Resistance of Collar Bearing | * Written tests |
| 1. Apply dimensional and models analysis fluids | * 1. Definition of terms      1. Dimensional homogeneity      2. Methods of solving dimensional analysis         1. Rayleigh’s theorem         2. Buckingham π theorem   2. Dimensional analysis similitude      1. Geometric      2. Kinematic      3. Dynamic   3. Dimensionless Numbers      1. Reynold’s Number (Re )      2. Froude’s Number (Fe )      3. Euler’s Number (Eu )      4. Weber’s Number (We )      5. Mach’s Number ( M )   4. Model test analysis and calculations      1. Classification of Models         1. Undistorted Models         2. Distorted Models         3. Scale Ratios for Distorted Models | * Written tests |
| 1. Operate fluid pumps | * 1. Principles of operation of:      1. Reciprocating pumps      2. Centrifugal pumps   2. Derivation of equations for a reciprocating pump      1. Coefficient of discharge      2. percentage slip      3. Work done      4. Acceleration head      5. Friction head      6. Pressure head in the cylinder   3. Application of reciprocating pumps equations to solve problems   4. Derivation of equations for a centrifugal pump      1. Effective head      2. Manometric head      3. efficiency      4. Mechanical efficiency      5. Discharge      6. Torque      7. Work done unit weight      8. Specific speed   5. Application of centrifugal pumps equations to solve problems | * Written tests |

**Suggested Delivery Methods**

* Group discussions
* Demonstration by trainer
* Online videos
* Power point presentation
* Exercises by trainee

**Recommended Resources for 30 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio (Item: Trainee)** |
| **A** | **Learning Materials** | | | |
|  | Textbooks | * + - 1. Applied Thermodynamics For Engineering Technology (fifth edition) by T.D. Eastop and A. McConkey       2. Engineering Thermodynamics by R.K.Rajput       3. A Textbook Of Fluid Mechanics And Hydraulic Machines by R.K.Rajput       4. A Textbook Of Fluid Mechanics And Hydraulic Machines by R.K Bansal | 30 |  |
|  | Projector | Functional projector for displaying content during presentations | 1 | 1:30 |
|  | Computer | Functional desktop computer with online instructional content | 1 | 1:30 |
|  | White board | Quality whiteboard of approximately 6 ft by 3 ft for writing during theory instruction | 1 | 1:30 |
|  | Printer | An ink-jet, laser-jet or toner-cartridge printer for printing notes, instructions and working drawings | 1 | 1:30 |
| **B** | **Learning Facilities & Infrastructure** | | | |
| 4. | Lecture/Theory Room | Spacious room with seats for 25 trainees, approximately 60 sqm | 1 | 1:30 |
| **C** | **Materials and Supplies** | | | |
|  | Dust coat/ overall | Shields skin and regular clothes from sparks | 30 | 1: |
|  | Fire extinguishers | Protect against fire | 30 | 3 |
|  | First Aid kit | Fully equipped First Aid kit for use in case of accidents | 1 | 1:30 |

**CORE UNITS OF LEARNING**

**VEHICLE STRUCTURE FABRICATION**

**ISCED UNIT CODE:** 0716 551 26A

**Relationship to occupational standards**

This unit addresses the unit of competency: Fabricate vehicle structure.

**Duration of unit:** 160 Hours

**Unit Description:**

This unit describes the competencies required by an Autobody technician to fabricate automotive structure. It involves cutting metal work pieces, bending metal work pieces, prepare fabrication jigs, join jigged work pieces, mount fabricated structure and fabricate vehicle body ancillary units.

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
|  | Cut Metal Work Pieces | 20 |
|  | Bend Metal Work Pieces | 20 |
|  | Prepare Fabrication Jigs | 20 |
|  | Join Jigged Work Pieces | 30 |
|  | Mount Fabricated Structure | 20 |
|  | Fabricate Vehicle Body Ancillary Units | 50 |
| TOTAL | | 160 |

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Cut metal work pieces | * 1. Workplace health and safety.      1. Overall      2. Safety boots      3. Goggles,      4. Earmuffs      5. Gloves      6. Helmet      7. Safety mask   2. Vehicle structural drawing interpretation   3. Vehicle body fabrication materials      1. Angle sections      2. Square      3. Rectangular tubes      4. Channel bars      5. Flat bars      6. Circular tubes      7. Round bars   4. Marking out and cutting      1. Marking Out Techniques for Fabrication      2. Marking out tools      3. Scribes      4. Punches      5. Chalk      6. rulers.      7. Marking table      8. Hacksaw      9. Laser cutting machine      10. Plasma cutting machine      11. Gas cutting equipment   5. Working drawing interpretation   6. Marking out procedure   7. Scrap disposal procedures      1. Scrap management      2. Scrap disposal regulations      3. Scrap disposal. | * Practical * Written tests * Project * Third party report |
| 1. Bend metal work pieces | * 1. Types and usage of metal bending machines      1. Hydraulic bending machine      2. Pneumatic bending equipment      3. Mechanical pipe benders   2. Preparation for bending      1. Working Drawing interpretation      2. Measuring and Marking for Bending   3. Bending of metal work pieces      1. Air bending      2. Bottom bending      3. Coining      4. Bending machine operation | * Practical * Written tests * Project * Third party report |
| 1. Prepare fabrication jigs | * 1. Introduction to fabrication jigs      1. Template jig      2. Plate jig      3. Diameter jig      4. Channel jig      5. Ring jig      6. Box jig   2. Types of jigs used in vehicle body fabrication      1. welding jigs      2. assembly jigs      3. positioning jigs   3. Design of structure Jigs Based on Working Drawings      1. Under structure      2. Left side structure      3. Right side structure      4. Roof structure      5. Front structure      6. Rear structure      7. Cross members   4. workpieces joining      1. welding      2. bolting      3. riveting      4. adhesives   5. Jigs mounting and placement      1. Clamps      2. Screws      3. bolts   6. Jigs adjustment and testing based on structural variations   7. Alignment and positioning of jigs | * Practical * Written tests * Project * Third party report |
| 1. Join jigged work pieces | * 1. Safety procedure in welding      1. Helmets      2. Gloves      3. Apron      4. Welding shield   2. Vehicle welding materials      1. Steel      2. Aluminum      3. stainless steel   3. welding preparation      1. grinders      2. clamps      3. measuring tools   4. Types of welding      1. MIG      2. TIG      3. arc welding      4. gas welding   5. Types of welding machines; MIG, TIG, Arc, Gas      1. Key machine settings         1. Voltage         2. Amperage         3. wire feed speed      2. Electrode Selection         1. Consumable electrodes         2. non-consumable         3. Electrode classifications         4. E6010         5. E7018 for steel welding         6. Electrode material         7. Thickness of workpieces      3. Standard operating procedures (SOPs) for welding machines in the workshop   6. Tack Welding      1. Purpose of tack welding in fabrication      2. Symbols and instructions for tack welding   7. Tack Welding Techniques      1. Tack welding for different joint types      2. butt joints      3. lap joints      4. T-joints   8. Tacked structure inspection as per the design drawing      1. Dimensions      2. Alignment      3. placement | * Practical * Written tests * Project * Third party report |
| 1. Mount fabricated structure | * 1. Vehicle structure diagonals      1. Diagonals structural accuracy      2. Diagonal measurements from structural drawings      3. tape measures      4. laser distance meters      5. calipers   2. Diagonal Errors      1. Adjusting diagonal measurements      2. tolerance limits for proper fitment   3. Leveling in Vehicle Fabrication      1. Importance of leveling      2. Chassis alignment      3. Body alignment   4. Drawing Specifications for Leveling      1. datum points      2. reference lines   5. Tools used for leveling the structure      1. spirit levels      2. laser levels      3. digital inclinometers   6. Structure adjustments for Leveling      1. Structure mounting on the chassis.         1. Role of chassis in vehicle construction         2. chassis mounting points from the working drawings         3. Specifications for bolt patterns, fasteners, and joining methods   7. Structure mounting techniques      1. Structure mounting procedure      2. Hoists      3. Cranes      4. torque wrenches      5. Alignment   8. Mounting safety      1. lifting and mounting large structures      2. proper torquing   9. Mounted structure inspection      1. Structural integrity      2. weld quality      3. alignment      4. dimensional accuracy   10. Inspection Tools       1. tape measures       2. calipers       3. straight edges       4. weld gauges       5. Non-destructive testing       6. ultrasonic testing       7. dye penetrant testing   11. Inspection checklist and inspection documentation | * Practical * Written tests * Project * Third party report |
| 1. Fabricate vehicle body ancillary units | * 1. Workplace safety      1. OSHA      2. local safety standards   2. Personal protective equipment (PPE)      1. Helmets      2. Gloves      3. eye protection      4. respiratory protection,      5. hazardous materials handling   3. Fabrication tool selection criteria      1. Cutting      2. Shaping      3. Grinding      4. welding machines, clamps      5. grinders      6. wire brushes   4. Ancillary Materials      1. Brackets      2. Fasteners      3. Seals      4. Insulation      5. Adhesives   5. Ancillary Workpieces preparation      1. Cleaning      2. Cutting      3. marking out      4. deburring      5. grinding      6. rust removal   6. welding machine settings      1. Voltage      2. Amperage      3. wire feed speed   7. Electrode Selection      1. Consumable electrodes      2. non-consumable      3. Electrode classifications      4. E6010      5. E7018 for steel welding   8. Welding ancillary units      1. MIG      2. TIG      3. Arc      4. Gas      5. Welding symbols and specifications for joint design      6. Welding Procedures and techniques   9. Ancillary unit inspection.      1. Structural integrity      2. weld quality      3. alignment      4. dimensional accuracy | * Practical * Written tests * Project * Third party report |

**Suggested Methods of Instruction**

* Practical
* Project Work
* Demonstrations
* Direct instruction
* Group Discussions

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio (Item: Trainee)** |
| **A** | **Learning Materials** | | | |
|  | Textbooks | Comprehensive textbooks on Motorcycle Mechanics | 25 | 1:1 |
|  | Projector | Functional projector for displaying content during presentations | 1 | 1:25 |
|  | Computer | Functional desktop computer with online instructional content | 1 | 1:25 |
|  | White board | Quality whiteboard of approximately 6 ft by 3 ft for writing during theory instruction | 1 | 1:25 |
|  | Printer | An ink-jet, laser-jet or toner-cartridge printer for printing notes, instructions and working drawings | 1 | 1:25 |
| **B** | **Learning Facilities & Infrastructure** | | | |
|  | Lecture/Theory Room | Spacious room with seats for 25 trainees, approximately 60 sqm | 1 | 1:25 |
|  | Workshop | Standard workshop with bench/fitting area and welding booths approximately 180 sqm | 1 | 1:25 |
| **C** | **Materials and Supplies** | | | |
|  | Dust coat/ overall | Shields skin and regular clothes from sparks | 25 | 1:25 |
|  | Welding Gloves | Shields hands from sharp edges, heat, and chemical exposure | 25 | 1:1 |
|  | Safety boots | Protects feet from heavy objects, sharp materials, and impact. | 25 | 1:1 |
|  | Ear muffs/ ear plugs | Shields against prolonged exposure to high noise levels from machinery | 25 | 1:1 |
|  | Welding shield and goggles | Protects eyes from flying metal particles, sparks, and dust | 25 | 1:1 |
|  | Vehicle fabrication materials | (angle sections, square sections, rectangular tubes, channel bars, flat bars, circular tubes, round bars - sufficient quantities) | 5 | 1:5 |
|  | Filler rods |  | 5 | 1:5 |
|  | Gas Regulators |  | 5 | 1:5 |
|  | Oxygen and acetylene cylinders |  | 5 | 1:5 |
|  | Inert Gas cylinder |  | 5 | 1:5 |
|  | Arc Welding electrode |  | 5 | 1:5 |
|  | Brazing and gas welding rods |  | 5 | 1:5 |
|  | Bolts, Nuts and Screws | For mechanical joining | 5 | 1:5 |
| **D** | **Tools and Equipment** | | | |
| **Measuring tools** | | | | |
|  | Tape measures |  | 5 | 1:5 |
|  | Vernier calipers, |  | 5 | 1:5 |
|  | Spirit levels |  | 5 | 1:5 |
|  | Steel rule |  | 5 | 1:5 |
| **Fastening tools** | | | | |
|  | Full Spanner Sets | For fastening bolts and nuts | 5 | 1:5 |
|  | 6-piece Screwdriver Sets | For fastening screws | 5 | 1:5 |
|  | Torque Wrenches | For fastening bolts and nuts at specific torque | 5 | 1:5 |
| **Striking Tools** | | | | |
|  | Hammers | For striking | 10 | 1:3 |
|  | Soft hammers | For striking soft parts without damaging | 10 | 1:3 |
|  | Chipping Hammer | For removing slug | 10 | 1:3 |
| **Cutting tools** | | | | |
|  | Chisel | For cutting | 5 | 1:5 |
|  | Combination Pliers | For various functions including cutting and holding. | 5 | 1:5 |
|  | Tinsnips | For cutting sheet metals | 5 | 1:5 |
|  | Hacksaw | For cutting metal parts | 5 | 1:5 |
|  | Files | For Edge Preparation | 5 | 1:5 |
|  | **Marking tools** | | | |
|  | Scriber | For marking out | 5 | 1:5 |
|  | Angle plate | For marking out | 5 | 1:5 |
|  | Chalk | For marking out | 5 | 1:5 |
| **E** | **Machines and Equipment** | | | |
|  | Gas cutting equipment | For cutting metals | 1 | 1:25 |
|  | Metal bending machines | (hydraulic, pneumatic, mechanical) | 1 | 1:25 |
|  | MIG welding machine | For welding metals together | 2 | 1:12.5 |
|  | TIG welding machine | For welding metals together | 2 | 1:12.5 |
|  | ARC welding machine | For welding metals together | 2 | 1:12.5 |
|  | SPOT welding machine | For welding metals together | 2 | 1:12.5 |
|  | GAS welding machine | For welding metals together | 2 | 1:12.5 |
|  | Jigs | (template, plate, diameter, channel, ring) | 5 | 1:5 |
|  | Clamps | For holding metals while welding | 5 | 1:5 |
| **F Special Tools** | | | | |
|  | Cleaning brush |  | 5 | 1:5 |
|  | Grinders |  | 5 | 1:5 |
| **G** | **Reference Materials** | | | |
| 1 | Operation sheets/ templates |  |  |  |
| 2 | Manufacturers service manuals |  | 25 pcs | 1:1 |
| 3 | Training Presentations/Slides | Digital format for shared access among trainees | 1 | 1:25 |
| 4 | Practical Assessment Guides | Worksheets for practical assessments | 25 pcs | 1:1 |

**VEHICLE BODY PARTS ASSEMBLY**

**UNIT CODE:** 0716 551 27A

**Relationship to Occupational Standards**

**This unit addresses the Unit of Competency:** Assemble Vehicle Body Parts

**Duration of Unit: 150 Hours**

**Unit Description**

This unit describes the competencies required by autobody technician in order to assemble vehicle body parts. It involves, installing vehicle seats, performing vehicle glazing, installing vehicle electrical components, install vehicle mechanical components and installing vehicle auxiliaries.

**Summary of learning outcomes**

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| **1.** | Install vehicle seats | 30 |
| **2.** | Perform vehicle glazing | 30 |
| **3.** | Install vehicle electrical components | 40 |
| **4.** | Install vehicle mechanical components | 30 |
| **5.** | Install vehicle auxiliaries | 20 |
| Total | | 150 |

**Learning outcomes, content, suggested assessment methods.**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Install vehicle seats | * 1. Safety      1. Personal protective equipment         1. Goggles         2. Earmuffs         3. Safety mask         4. Helmets         5. Safety boots         6. Leather gloves         7. Overall   2. Vehicle floor panel marking      1. Marking methods      2. Surface preparation      3. Durability testing      4. Design specifications   3. Vehicle carpet and seats fitting      1. Material selection      2. Installation techniques      3. Customization options      4. Compatibility with vehicle models | * Practical * Written tests * Project * Third party report |
| 1. Perform vehicle glazing | * 1. Glass and body panel fitting      1. Compatibility and fitment      2. Structural integrity      3. Sealing and weatherproofing      4. Types of glass (laminated, tempered)      5. Impact resistance and safety standards   2. Adhesive application      1. Types of glazing adhesives      2. Surface preparation techniques      3. Application methods (e.g., bead application)      4. Curing and setting times      5. Environmental considerations (temperature, humidity)   3. Vehicle windscreen fitting      1. Preparation and removal      2. Adhesive application      3. Installation techniques      4. Post-installation testing and quality checks   4. Glass window winding installation | * Practical * Written tests * Project * Third party report |
| 1. Install vehicle electrical components | * 1. Identification of electrical components.      1. Key electrical components in bodywork      2. Wiring and harnesses      3. Body control modules      4. Grounding and electrical connections   2. Fitting electrical components.      1. Preparation for fitting electrical components      2. Identifying electrical component locations      3. Fitting lighting systems      4. Fitting sensors and actuators      5. Wiring and harness installation      6. Connecting and securing components   3. Electrical component testing | * Practical * Written tests * Project * Third party report |
| 1. Install vehicle mechanical components | * 1. Vehicle mechanical components      1. Frame and chassis components      2. Doors and hinges      3. Windows and glass systems      4. Side mirrors      5. Rear view mirror      6. Fenders and body panels      7. Bumpers and impact absorption      8. Hood and trunk mechanisms      9. Suspension attachments      10. Body reinforcement and safety structures   2. Mechanical components installation      1. Preparation and planning      2. Door installation      3. Window and glass installation      4. Body panel installation      5. Final fitting and adjustments   3. Mechanical components tests and fitness      1. Frame and chassis assessment      2. Alignment and fitment testing      3. Functional testing         1. Door and window operation         2. Hood and trunk mechanism functionality         3. Latch and lock mechanism testing | * Practical * Written tests * Project * Third party report |
| 1. Install vehicle auxiliaries | * 1. Auxiliary units      1. Chevrons      2. Reflector strip      3. Round reflectors      4. Parcel rack   2. Fitting vehicle body auxiliary units      1. Installation of reflector strips      2. Fitting round reflectors      3. Parcel rack installation   3. Vehicle body fittings and installation techniques      1. Alignment and adjustment of body panels      2. Fitting exterior components      3. Integration of windows and glass   4. Body works documentation      1. Documentation of material specifications and standards      2. Quality control checklists and inspection records      3. Documenting parts replacement and upgrades | * Practical * Written tests * Project * Third party report |

**Suggested Methods of Delivery**

* Practical
* Projects
* Demonstrations
* Group discussion
* Direct Instructions

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio (Item: Trainee)** |
| **A** | **Learning Materials** | | | |
|  | Textbooks | Comprehensive textbooks on Motorcycle Mechanics | 25 | 1:1 |
|  | Projector | Functional projector for displaying content during presentations | 1 | 1:25 |
|  | Computer | Functional desktop computer with online instructional content | 1 | 1:25 |
|  | White board | Quality whiteboard of approximately 6 ft by 3 ft for writing during theory instruction | 1 | 1:25 |
|  | Printer | An ink-jet, laser-jet or toner-cartridge printer for printing notes, instructions and working drawings | 1 | 1:25 |
| **B** | **Learning Facilities & Infrastructure** | | | |
|  | Lecture/Theory Room | Spacious room with seats for 25 trainees, approximately 60 sqm | 1 | 1:25 |
|  | Workshop | Standard workshop with bench/fitting area and welding booths approximately 180 sqm | 1 | 1:25 |
| **C** | **Materials and Supplies** | | | |
|  | Dust coat/ overall | Shields skin and regular clothes from sparks | 25 | 1:25 |
|  | Gloves | Shields hands from sharp edges, heat, and chemical exposure | 25 | 1:1 |
|  | Safety boots | Protects feet from heavy objects, sharp materials, and impact. | 25 | 1:1 |
|  | Ear muffs/ ear plugs | Shields against prolonged exposure to high noise levels from machinery | 25 | 1:1 |
|  | Safety goggles | Protects eyes from flying metal particles, sparks, and dust | 25 | 1:1 |
|  | First aid kit | For first aid | 5 | 1:5 |
|  | Replacement panels | (doors, hoods, fenders) | 5 | 1:5 |
|  | Adhesives and sealants | (for bonding panels) | 5 | 1:5 |
|  | Nuts, bolts, and screws | (various sizes) | 50 | 2:1 |
|  | Clips and retainers |  | 50 | 2:1 |
|  | Rivets and washers |  | 50 | 2:1 |
|  | Sanding discs and finishing pads |  | 25 | 1:1 |
|  | Rags, solvents, and degreasers | for surface preparation | 50litres |  |
| **D** | **Tools and Equipment** | | | |
| **Measuring tools** | | | | |
|  | Multimeters | For electric checks (Voltage, resistivity, amperage) | 5 | 1:5 |
|  | testing lamp | For circuit continuity tests | 10 | 1:3 |
| **Fastening tools** | | | | |
|  | Full Spanner Sets | For fastening bolts and nuts | 5 | 1:5 |
|  | 6-piece Screwdriver Sets | For fastening screws | 5 | 1:5 |
|  | Torque Wrenches | For fastening bolts and nuts at specific torque | 5 | 1:5 |
|  | Pliers | Needle-nose, slip-joint | 5 | 1:5 |
| **Striking Tools** | | | | |
|  | Hammers | For striking | 10 | 1:3 |
|  | Soft hammers | For striking soft parts without damaging | 10 | 1:3 |
| **Cutting tools** | | | | |
|  | Chisel | For cutting | 5 | 1:5 |
|  | Combination Pliers | For various functions including cutting and holding. | 5 | 1:5 |
|  | Tinsnips | For cutting sheet metals | 5 | 1:5 |
|  | Hacksaw | For cutting metal parts | 5 | 1:5 |
| **E** | **Machines and Equipment** | | | |
|  | Motor vehicle doors and door mechanism | For replacement | 5 | 1:5 |
|  | Motor vehicle bonnet and mechanism | For replacement | 5 | 1:5 |
|  | Electric drills and bits | For drilling holes during assembly | 5 | 1:5 |
|  | Orbital sanders |  | 5 | 1:5 |
| **F Special Tools** | | | | |
|  | Impact wrenches | Air impact/hydraulic | 5 | 1:5 |
|  | Circlip Pliers (Internal and external) |  | 10 | 1:3 |
|  | Pullers | For pulling bearings | 5 | 1:5 |
| **G** | **Reference Materials** | | | |
| 1 | Vehicle bodywork installation manuals |  | 25 pcs | 1:1 |
| 2 | Manufacturers service manuals |  | 25 pcs | 1:1 |
| 3 | Training Presentations/Slides | Digital format for shared access among trainees | 1 | 1:25 |
| 4 | Practical Assessment Guides | Worksheets for practical assessments | 25 pcs | 1:1 |